ENGINEERING NEWS-RECORD

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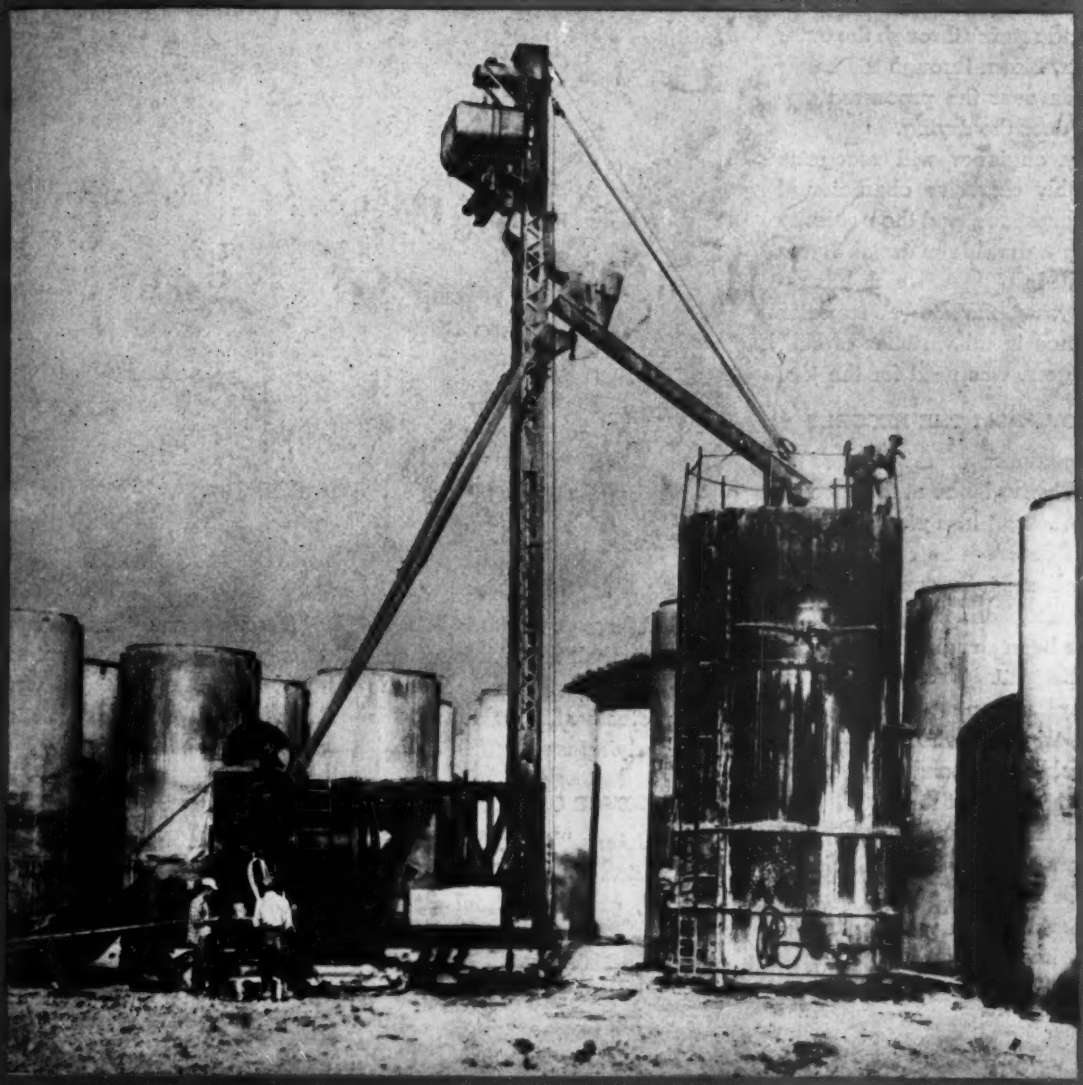


Paver with tower attachment and pouring chute casts 50-ton pipe for Cleveland water intake

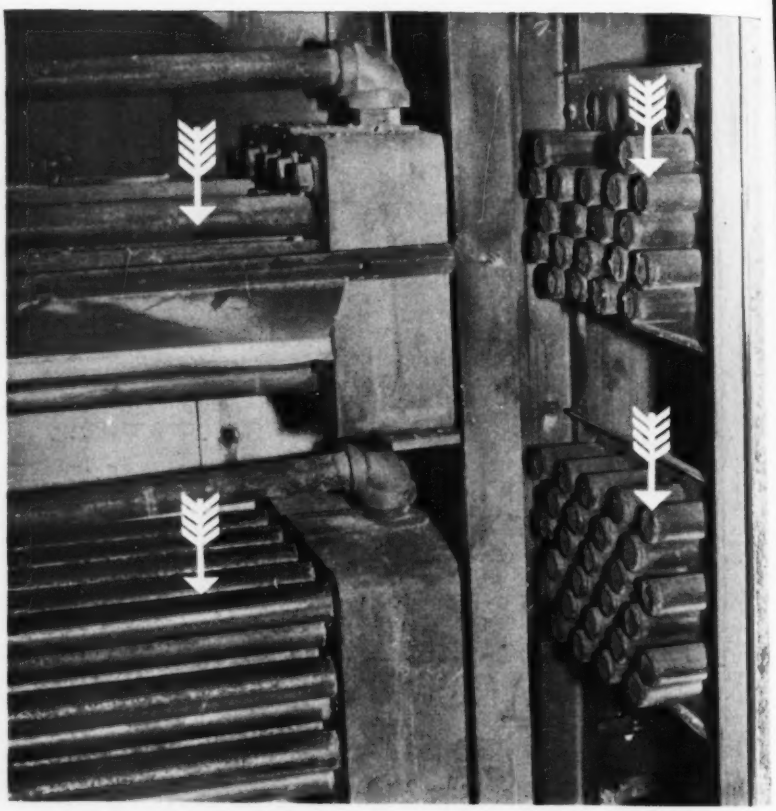
ARTICLES ON: **LUSTRON'S $14,000,000 GAMBLE**
SYMPOSIUM ON SANITARY SEWERS

Byers Wrought Iron Pipe

doubles up here—to combat corrosion

This drier has the job of dehydrating processed materials, as the last step in manufacture. A double-tube design is used, with a ⅜-inch pipe centered inside a 1¼-inch pipe, and secured in a manifold. Steam is passed through the inner pipe, and returns through the outer one. Air, blown through the banks and then over the processed materials, does the drying.

Every engineer will recognize the highly corrosive character of these conditions, and the necessity of using a durable material. Byers Wrought Iron pipe, which has repeatedly demonstrated its superior endurance in all varieties of heat exchangers, was used for the job.



PROOF FROM THE RECORDS

The soundness of this choice is verified by a glance at the record. Byers Wrought Iron pipe has been used in double-tube atmospheric, and shell-and-tube condensers, in economizers, and in pre-heaters, and has been remarkably successful in eliminating excessive repairs and replacements. To cite one typical example—the inner pipes of a double-pipe condenser, made of a low-first-cost material, developed leaks in only one year. Replacements were made with Byers Wrought Iron pipe. At last reports it had served 11 years with no trouble, and no sign that the end of its usefulness was anywhere in sight.

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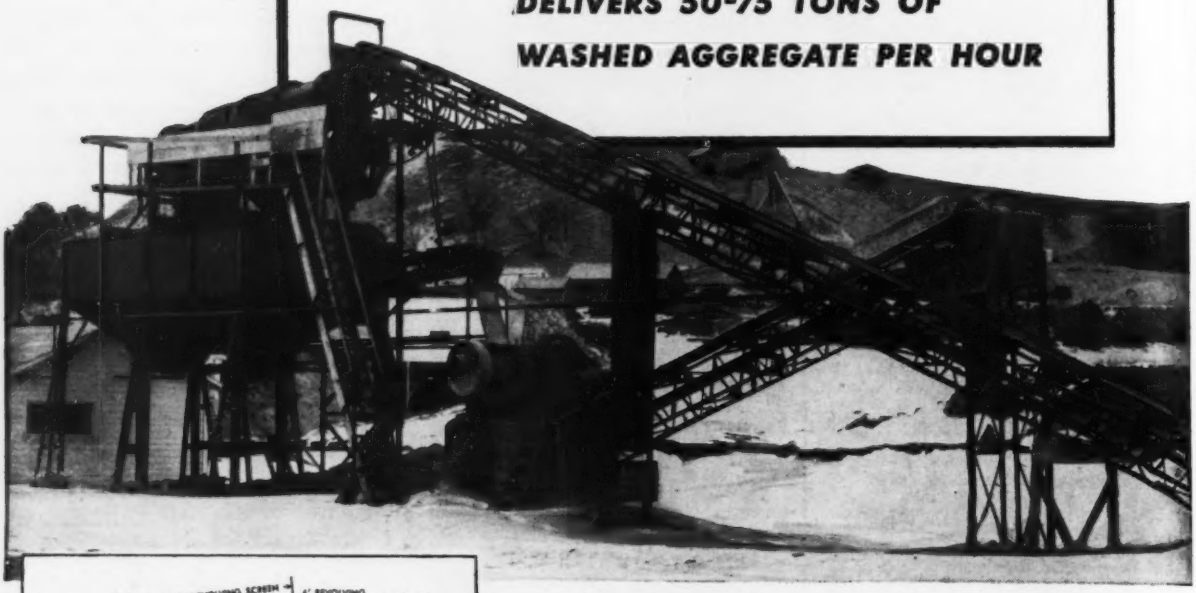

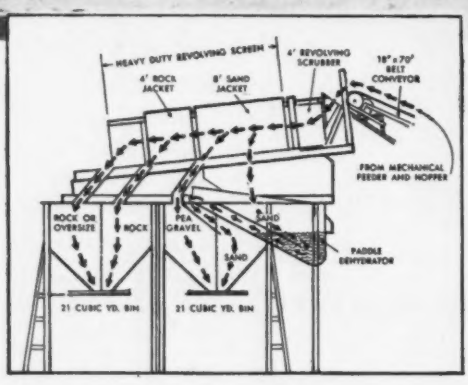

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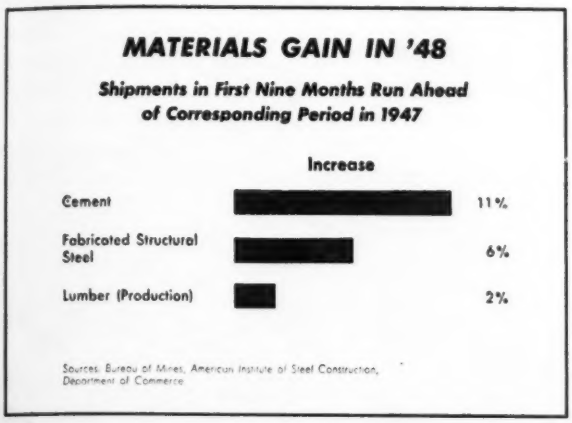
CONSTRUCTION TRENDS



SUBSIDIES for 500,000 low-rent housing units and for $1.5 billion of slum-clearance, new government dam and power projects . . . these and many other ideas are in the headlines as the new Congress plans to make good on campaign pledges.

They clearly suggest that the election returns foreshadow a lot of new business for the construction industry. They add new strength to the industry's outlook for 1949.

But there is a hitch—materials.

Construction is limited by materials now. The industry as a whole is surging ahead to catch up with postwar demand. Through the first 10 months of 1948 it put in place some $14.7 billion worth of new work, according to Department of Commerce reports. Measured that way, in dollar volume, construction volume is running 31% ahead of last year.

But much of this increase represents only increases in costs and prices. How much is indicated by the fact that, while dollar volume is up 31%, production of materials on the whole is only some 5% to 10% ahead of 1947.

FOR CONSTRUCTION that is important. It sets the ceiling on the physical volume of production.

What are the chances that, with demand certain to be heavy in 1949, the ceiling on materials will be lifted?

Let's take a look at the three basic materials used in almost all construction—lumber, steel and cement. As the chart above shows, lumber production is running only some 2% ahead of 1947, shipments of fabricated structural steel are up 6%, and cement shipments have increased by 11%.

WHAT ARE THE PROSPECTS for lumber, steel and cement next year?

Lumber mills—most of them—were operating at capacity in early 1948. If demand had held high through the year, they might have topped last year's production by 5%. But falling prices have already resulted in cuts in production of lower-grade lumber. Some of the smaller, high-cost operators shut down as prices began to break in mid-year. So, even with a new hike in prices, is would be unlikely that 1949 will see any more lumber turned out than this year. Moreover, top grades are short even now, and certainly won't be easier to get next year.

The steel story is different. It will depend next year on overall steel production and on demand for other types of steel. There will be more capacity. The industry will go into 1949 with a million tons more basic capacity than it had at the beginning of 1948. It may well turn out more steel than ever before, including the war years. But there's no let-up in demand in sight. There'll be more steel—but still not enough.

With that prospect, there's a possibility that the government will increase or extend allocations of steel. It's too early to tell what that might mean. But, without more special allocations, a 5% increase in construction types of steel is probably the best the industry can expect.

Cement production has been upped this year by increasing efficiency in the industry and by running mills at close to capacity. Where the industry was producing at 86% of capacity in August, 1947, it was running at 91% a year later. The record in the first 9 months shows shipments 11% ahead of 1947. But that includes the peak summer months. The year-end report will be shaded somewhat, is likely to put output about 7% ahead of 1947.

Even with the high summer production, reports of spot shortages were increasing in September. Next year may see a slight increase in production—but if demand holds high there probably won't be enough cement again in some areas.

ALL IN ALL, the materials outlook puts a limit on what the government can do about construction—as it has ever since the war. If Congress pushes through a big low-rent housing program and slum clearance projects, and more dam projects, the materials must be found by diverting them from other uses.

For construction as a whole, the prospect for materials means that the industry may increase its physical volume in 1949 about as much as it did this year—5% to 10%. There certainly won't be enough material to do all the jobs that are crying to be done.

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THE CONSTRUCTION WEEK

FOREIGN CEMENT—A natural result of our tight cement supply situation can be expected soon in the appearance of foreign cement on the domestic market. Already small quantities of Belgian cement have come into Florida ports and into New Orleans. One carload is reported to have gotten as far inland as Toledo. Not only Belgium but Germany and perhaps Spain and Portugal stand ready and anxious to get American dollars via cement sales. Only lack of shipping space keeps them from cashing in on a larger scale. U. S. ready-mix plants are particularly avid customers.

EQUIPMENT SALES—Discount the idea, expressed frequently of late, that a seeming sluggishness in construction equipment sales is due to the cement shortage. The claim that any appreciable number of jobs is being postponed or abandoned because of lack of cement could not be substantiated by a nationwide survey made recently by ENR. And there was no evidence that tightness in cement supply was holding back equipment buying. Rather than adopting this convenient excuse, some equipment manufacturers are delving a little deeper, finding that dealers and contractor customers are returning to a seasonal buying pattern. Prewar, equipment sales in the fall and early winter were always sluggish.

SANITARY KNOW-HOW—Acknowledgment of the soundness of U. S. philosophy in stressing sanitation and public health measures as basic steps in development of backward countries is behind a British move to send an engineer-observer to visit this country to study teaching and training. U. S. cooperative sanitation programs with South American countries will be scrutinized in relation to Great Britain's aspirations for improving its colonial development program—particularly in Africa (ENR Oct. 7, p. 8).

COORDINATING COLUMBIA PLANS—The recently issued Corps of Engineers report on the Columbia River basin does not seriously disagree in fundamentals with the Bureau of Reclamation study submitted on Feb. 8, 1947. Designed to complement the earlier report, which dealt chiefly with upstream irrigation work, the plan devised under Col. Theron D. Weaver's supervision is mostly concerned with downstream flood control projects. Coordination of the two plans where they overlap—as in the case of Hell's Canyon, which both agencies would like to build (ENR July 1, p. 6)—began last week in Washington. Final recommendations of the two agencies will go to the Bureau of the Budget and then to President Truman for presentation to Congress early in 1949.

SINKING FEELING—The fact that the curious and baffling land subsidence at Long Beach, Calif., is now the subject of well-organized, cooperative study (ENR Oct. 7, p. 7) does not prove that the several interests have forgotten their differences, particularly in the matter of responsibility for damage. A subsidence of 8 ft., still continuing and involving a large power plant, a graving dock and other structures, is too expensive to be lightly dismissed if legal responsibility can be fixed. Differences of opinion, only simmering now, could easily heat to the litigation point. It is not clear as yet which of two sets of laws apply; boundaries of tidelands may change, legally, (1) "by little and little" or (2) "by evulsion." People of Long Beach want to know whether they have suffered an evulsion, and they also wonder who is to pay for it.

ON THE CONGO—Spurred by discoveries of uranium, copper, tin and zinc, the Belgian government may be expected to step up its development plans for the Congo Basin in Africa. Among plans under consideration is channel dredging on the river proper and construction of a 20-ft. high by 1,000 ft. long concrete dam to increase the storage capacity of Lake Tanganyika. Egide J. Devroey, for 20 years head of colonial engineering work in the Congo, just concluded a two-month survey of U. S. river development projects, preparatory to submitting a report on the Congo.

MORE RIVER DEVELOPMENT—Look for a supplemental appropriations bill seeking more funds for federal power, reclamation and flood control works as soon as the new Congress is in session. Washington insiders report that on White House orders, a number of federal agencies have been quietly conferring among themselves and with the Bureau of the Budget on their needs.

WORK RELIEF—Ways to relieve the overload on the California state architect's office are being studied by representatives of several engineering societies, headed by H. J. Brunnier, San Francisco consulting engineer. Object is to find means, without state law changes, for transferring some state design work to competent private firms.

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Vibration in Thin Dams

WHAT EFFECTS MAY RESULT from long-continued vibration in thin concrete arches? Little reference data seem to be available, but the question will interest anyone who has stood in the inspection gallery of a concrete dam and has felt and heard there an ominous, pounding vibration. Spillways over such dams should be so designed that overpouring water flows smoothly, without turbulence or cavitation, causing no vibration in the structure. Ideal conditions, however, do not always obtain. Moreover, the commonest form of vibration in dams is that transmitted from the foundation rock under the irregular pounding of falling water. Even where a stilling basin cushions the shock and where solid rock obviates any danger of undermining, vibration sometimes occurs and may reach disturbing magnitude. Nowadays, when so many hydraulic problems are being solved with models, it is to be noted that the law of homologous similitude does not apply to vibration and hence this is one hydraulic subject in whose study models cannot be used. With dams getting higher and thinner, as the design technique develops, it would be reassuring to have some commensurate progress in knowledge of vibrational effect on thin dams.

Road Maintenance By Contract

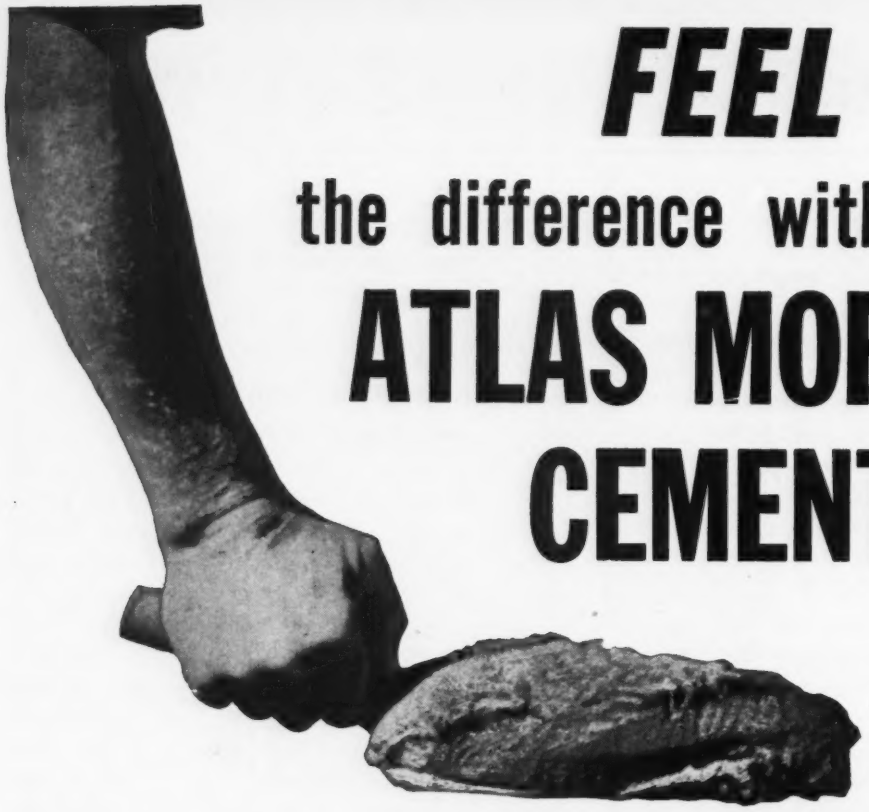
UNPRECEDENTED NEED for large-scale highway maintenance has resulted in some states performing a large part of this work by contract. Others, seeking to provide year-round employment of state maintenance crews, and believing that maintenance by contract would be more expensive, have clung to the policy of using their own forces. If either of these policies is providing adequate maintenance, well and good. Where, however, dangerous chuckholes in an old pavement, deteriorated bridge railings and the like still persist, additional means of maintenance must be sought. The success, to date, of contracting the repair of flexible pavement demonstrates what can be done in this particular field. Conscientious analysis by the maintenance engineer of the scope and character of the several items of maintenance needed to permit our highway plant to give maximum service, will often point the way to better accomplishment of the job at hand. Whether the choice favors contract, state forces or both is immaterial. But the possibilities of using contractors to augment other efforts should not be overlooked.

Houses From the Factory

WITH HOUSING STILL SHORT in many parts of the United States, the whole country is eagerly watching the Lustron Corp. experiment in manufacturing and marketing porcelain-enameled steel houses. Factory building of houses has been attempted before, but never on such a grand scale as a planned production rate of 45,000 units per year. Moreover, many barriers over which other prefabricators have stumbled—labor jurisdiction, marketing problems and public acceptance—appear to have been successfully hurdled. Dealer-erectors have been assigned in most strategic areas, and building officials, in general, are favorably disposed. Shortage of steel is the one big cloud on the horizon. For the sake of the public, which too often finds conventional houses too costly, it would be a pity if this first big chance to test the factory-built house idea should be inconclusive for lack of material.

For Work Anonymously Performed

SIGVALD JOHANNESSON retired a few days ago as director of the division of planning and economics of the New Jersey State Highway Department. In comment, the *Newark News* said: "For the most part the labor of the engineer is anonymously performed and seldom does he receive as an individual the acclaim that he merits for his contribution to the public comfort, convenience and well-being." Over the years, similar comment could have been made—but seldom was—about many engineers and construction men whose unmarked monuments are all about us. And in the years to come, much the same can be said of others who today are bringing skillful analysis and sound reasoning to their daily tasks. At best, however, public acclaim is ephemeral. For engineers like Sigvald Johannesson there is the deeper and more lasting award that comes from the knowledge that they put their best into "work anonymously performed" regardless of whether it was designing a super highway or compiling routine traffic counts.



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ENGINEERING NEWS-RECORD

NOVEMBER 25, 1948 VOL. 141 NO. 22

Study favors parallel span as San Francisco Bay crossing

Toll Bridge Authority recommends earliest possible construction start on $155 million bridge—Report compares traffic and cost features of two possible crossings

A parallel San Francisco-Oakland Bay Bridge to cost $155 million was recommended in a report presented to the California Toll Bridge Authority on Nov. 16 by R. A. Tudor, chief engineer of the Division of San Francisco Bay Toll Crossings (*ENR* Nov. 18, p. 5).

Recommendations that the crossing bridge, together with approaches on both sides of San Francisco Bay, be built at the earliest practical date and that the construction of the proposed southern crossing be deferred until it can be financed as another bay crossing was made by the division after a 10-month study and investigation.

Public hearings planned

The Toll Bridge Authority is expected to hold one or more public hearings within the next few weeks, at which time comment on the report will be invited. Shortly thereafter, a decision is anticipated. This will enable the bay toll crossings division to prepare detailed plans and specifications, perhaps having them ready by 1950. Financing could be arranged at the same time, and some preliminary construction might be undertaken.

Earlier studies

Studies by the crossings division centered on two crossings. One was a bridge parallel and northerly of the existing San Francisco-Oakland Bay Bridge, together with its approaches and including a tube under the Oakland Estuary with connections to the East Shore Freeway and the city of Alameda. The other was a low-level crossing—a combination of trestle, tubes and fill—connecting Army St. in San Francisco with Fifth St. in Alameda and including a crossing of the Oakland Estuary to connect with the East Shore Freeway. This latter was suggested by a joint Army-Navy board that reported on the bay crossing problem in 1947 (*ENR* Feb. 13, 1947, p. 3). It is usually referred to as the "southern crossing." Construction of the southern crossing was recommended in the Tudor report at some future date when it can be financed as a third bay crossing.

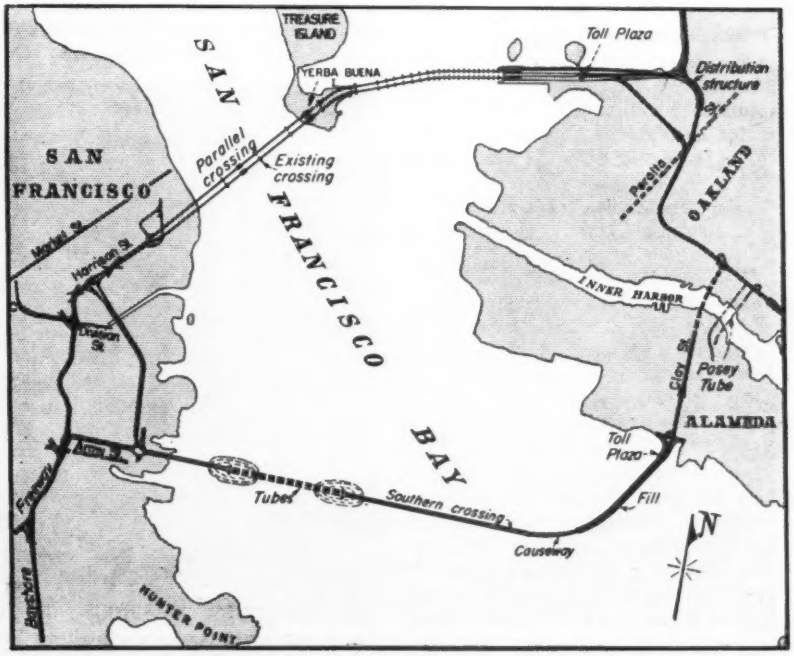
If a parallel bridge is built, the design will conform to the existing bridge. Each structure will become a one-way bridge. This will permit five lanes of auto traffic in each direction and two lanes of bus and truck traffic each way. Provision will be made on the new structure for future interurban electric train service should the facilities on the existing bridge become inadequate.

A new design was made for the southern crossing. As now proposed, this crossing would consist of two large artificial sand islands, one on each side of the main shipping channel connected by three subaqueous tubes, each of which would carry two traffic lanes. The tubes would pass under a channel that provides a minimum of 50-ft. clear depth of water for a distance of 1,500 ft. Vehicles will reach the islands from the San Francisco shore by means of a low trestle and from Alameda by a combination of low trestle and fill causeway. The tubes would have an internal diameter of 32 ft. and would be of concrete, cast in 200 ft. sections in drydock and sunk in place.

Traffic important

Traffic studies indicated that if a parallel bridge is built, the congestion on the existing bridge will be relieved as soon as the new bridge is completed, or about four years after the start of work. This relief will continue beyond 1970. If a southern crossing is built, requiring five and one half years, congestion on the existing bridge will be reduced but not eliminated and both crossings will again be congested during peak hours by 1965. Serious congestion on the San Francisco-Oakland Bay

(*Continued on p.* 42)



PROPOSED BAY CROSSINGS—The southern crossing, a causeway and tunnel combination, and the recommended parallel bridge both would join with freeways now under construction in the San Francisco Bay area.

NEWS BRIEFS

Bridges—BOSTON has asked Corps of Engineers approval of an 8-span, 539-ft. concrete bridge across the Charles River. Bridge plans feature a single leaf bascule draw-span of the rolling lift type. . . . Bids will be received until noon on November 30 by the DELAWARE State Highway Department on the second portion of the $40,000,000 Delaware Memorial Bridge, namely, construction of approach piers and anchorage blocks. . . . TOLEDO, OHIO, has filed application with the Corps of Engineers for authorization of construction of the proposed $5,200,000 South Toledo bridge over the Maumee River. . . . Dravo Corp., Pittsburgh, submitted a low bid of $2,087,000 for construction of substructure and approaches of the Speers-Belle Vernon Bridge over the Monongahela River, Pa.

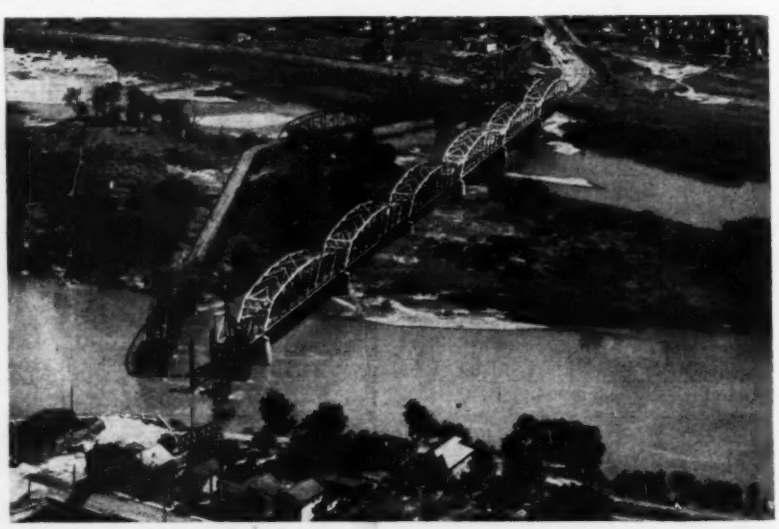
Dams—S. J. Groves & Son, of Minneapolis, and J. L. McLaughlin of Great Falls, Mont., submitted a combined low bid of $5,117,000 on Bureau of Reclamation Shadehill Dam recently. The 118-ft. high concrete structure will be on the Grand River near LEMMON, S. D. . . . Bids on construction of Conemaugh Dam in PENNSYLVANIA will be asked in January, and construction probably will begin April 1.

Housing—Low bid for construction of foundations for Nostrand Houses, a 24-acre project to provide 1,152 apartments in BROOKLYN, N. Y., was submitted by Melwood Construction Corp. the bid was $1,614,000. . . . New York State's first non-profit cooperative home development, Bell Park Gardens, has been started in BAYSIDE, QUEENS. The 800 unit housing project will be built and operated by the United Veterans Mutual Housing Corp. . . . At HOUSTON, TEX., Maurice Krull will build a $4,200,000 residential development of 700 homes on a 137-acre site. . . . A $10,000,000 apartment house with accommodations for more than 500 families will be built overlooking the East River in NEW YORK CITY by the Tishman Realty & Construction Co., Inc., beginning February, 1949. Plans call for three 12-story buildings. . . . Construction of a $25,000,000 building project at ANCHORAGE, ALASKA, including 500 homes and warehouse facilities, is proposed by the Pacific Alaska Development Co., of Seattle, Wash. . . . Ground was broken recently for construction of the $14,000,000 housing project in South BOSTON, MASS. . . . Jungclas Building Co. of CINCINNATI, OHIO, has proposed the construction of a $3,000,000 500-unit housing development of three-room apartments for the modest income families of that city. Macomber, Inc., prefabricated steel house manufacturers of CANTON, OHIO, has filed a patent infringement suit against Lustron Corp. Macomber has charged that the Lustron house contains in its steel frame a V-section protected for Macomber by the U. S. Patent Office.

Public Construction—On Nov. 2 voters of HARRIS COUNTY, TEX., approved a $6,000,000 bond issue to build a new county courthouse at HOUSTON. . . . Bids for the first units of a $65,000,000 Army construction program in ALASKA have been called by Col. W. E. Potter, district engineer, for opening on Dec. 16 at Anchorage. The first contract, estimated to involve $2,000,000, calls for construction of a 500-man barracks at FORT RICHARDSON. . . . A report made by the Educational Council for the OHIO Education Association shows that the state must spend $264 million on new school buildings within the next two years.

Water Supply and Sewers—Construction bids will be called in January on the first unit of the proposed $11,500,000 sanitary sewer system in TAMPA, FLA. . . . A $2,000,000 project for extension of the sewer system in ELMIRA, N. Y., and construction of a new treatment plant have been approved by the state public works department. . . . The Stream Pollution Control Board of INDIANA recently estimated that $47,000,000 must be spent by 89 Indiana cities and towns for new sewage treatment plants which are now in the planning stage. . . . Plans for a $3,000,000 system of storm sewers in TOLEDO, OHIO, have been approved by the Federal Works Agency, and bids will be sought early in 1949. . . . ORLANDO, FLA., has begun actual construction work on a $3,500,000 sewage disposal plant. . . . In DALLAS, TEX., the city council has approved spending of over $1,000,000 for expansion of the city's water system. . . . Finances are being worked out in EAST ST. LOUIS, ILL., for the construction of a proposed $6,000,000 improvement in the city sewer system.

Industrial Construction — Consolidated Western Constructors, Inc., of Houston, Tex., have been awarded a $10,000,000 contract to build the first unit of the $25,000,000 smelting plant of the Aluminum Company of America near PORT LAVACA, TEX. . . . Pennsylvania Power Co. will build an $11,500,000 addition to its NEW CASTLE, PA., plant. . . . Union Carbide & Carbon Corp. announces construction plans including three new plants to be begun this fall and completed at a total cost of $50,000,000 on the Ohio River south of MARIETTA, OHIO. . . . A $2,000,000 warehouse area in ATLANTA, GA., to provide five new warehouses with more than 241,000 sq.ft. of floor space is planned by the Atlantic Coast Line Railroad.



NEW SUSQUEHANNA CROSSING—Now completed at Wilkes-Barre, Pa., this seven-span steel truss state highway bridge replaces the old structure which is being dismantled for reuse elsewhere. Concrete piers on concrete piles were started in 1947. C. F. Goeringer Construction Co. held the general contract; Raymond Concrete Pile Co. put down the piles, and Bethlehem Steel Co. erected the superstructures.

Arizona water situation still serious

New reports by the U. S. Geological Survey and O. C. Williams, state land and water commissioner, emphasize the seriousness of dwindling underground water reserves, especially in the agricultural areas of Maricopa County in central Arizona.

Wells of the Salt River Valley dropped an average of 8 ft. in 1947-48 as pumps sucked 1,500,000 acre-ft. out of the ground, the report shows.

At the same time, the Salt River Valley Water Users Association, in an effort to augment insufficient reservoir supplies, has sold pump rights to 82,500 acre.ft. and is drilling wells to supply that amount for which shareholders have subscribed.

Meanwhile, reports indicate that the summer season runoff into reservoirs of the Salt River Valley system totaled only 60,300 acre-ft., nearly 80,000 acre-ft. less than what was stored during the same period last year.

This storage is depended on for recharge of the valley's underground water table. Storage in the reservoirs this year totals about 135,000 acre ft. Last year more than 700,000 acre ft. of gravity water was supplied to the basin.

In several areas, pumps now are lifting water more than 300 ft. Farmers admit the cost is high and say only high prices can keep the pumps operating.

The last good rain in Arizona was in 1941 and since that time the water level has dropped as much as 36 ft.

Unrestricted pumping and opening of new agricultural areas caused emergency adoption of a state groundwater code to control farming and water consumption. Under present conditions, experts foresee possible disaster for the agricultural future of Arizona unless supplemental water can be brought in from the Colorado River. It is along these lines that the state is working for passage of the Central Arizona Project, at the next session of Congress.

Suspend tests temporarily on underground explosions

Field activity on the Army's underground explosion test program has been suspended temporarily according to a recent announcement by Col. Joseph S. Gorlinski, district engineer at Sacramento, Calif.

The suspension order affected work at Sacramento and Salt Lake City and at explosion test sites near Dugway and Castle Dale, Utah, and Grand Junction, Colo.

Gorlinski emphasized that the project is not dead; it is being put into "moth balls," probably until next year.

Tunnel holed through at Delaware system dam

Downsville Dam, the third storage structure in New York City's Delaware Water Supply system, reached a signal construction stage Nov. 16 when its 2,150-ft. diversion tunnel was holed through.

The 40-ft. (finished diameter) tunnel, about a mile from Downsville, N. Y., on the East Branch of the Delaware River, was driven in one top heading from its upstream portal. The drift emerged at a rock face which is one side of the outflow stilling basin.

The final blast was witnessed by several hundred people, who stood downstream on the rock-paved bank of the outflow channel as one of their number, Vincent R. Impellitteri, president of the New York City Council, closed the switch. When the dust cleared, what had been a sheer cliff was now punctured by a semi-circular hole nearly 50 ft. wide and 30 ft. high.

Ceremonies leading up to the blast were conducted by Irving V. A. Huie, commissioner of the New York Board of Water Supply. Speakers included Jack MacDondald, project manager for Walsh Construction Co. and B. Perini and Sons, the contractor, and Mr. Impellitteri.

After emphasizing the importance of the Delaware project, Mr. Impellitteri cited those whose efforts and forebearance have eased the construction. First to be mentioned were the field organizations of the contractor and the Board of Water Supply. To the local people who have forgiven disruptions in their living routines, he was especially grateful.

Overall planning and pre-war construction for the Delaware Water Supply project have been discussed thoroughly by ENGINEERING NEWS-RECORD in articles published during 1940-42. Current work will be covered in two articles to appear soon.

West Rock twin tunnel holed through Nov. 9

Holing through the last barrier of the new West Rock twin tunnel, a part of the Wilbur Cross Parkway in Hamdon and Woodbridge, Conn., was accomplished Nov. 9 with ceremonies. Governor James C. Shannon pulled the switch and set off 400 pounds of dynamite. Five blasts broke through the west bore of the tunnel, the east bore having been broken through previously. The tunnel will cost $2,000,000.

The west tunnel will accommodate northbound traffic. Work began in March and boring late in June. It is already possible for work vehicles to pass through the east bore. A total of 96,541 cu. ft. of materials was removed for the bores, while materials going into the job to date include: 21,920 bl. of cement; 673,000 lb. of preformed steel bars; 365,000 of steel arch ribs, sills and columns; and 2,870 tons of broken stone base.

WAREHOUSE AND MANUFACTURING PLANT, now under construction at Santa Clara, Calif., will cost Owens Corning Fiberglas Corp. $7,000,000. Bethlehem Pacific Coast Steel Corp. fabricated over 2,000 tons of steel for the 350,000 sq. ft. layout. Bechtel Corp. is general contractor, and The Austin Co. is architect and engineer.

Over 500 new hospitals OK'd for federal aid

With more than 500 federal-aid hospital projects approved by last month, the billion dollar program of the U. S. Public Health Service has passed the quarter mark. A total of 506 projects approved at the end of the third quarter involve a total estimated cost exceeding $277 million, of which the federal share is nearly $85 million. Of these projects, 387 are for general hospitals or for additions or alterations in existing facilities. Among the remainder, the largest number—63—are for health centers.

The projects are going primarily into smaller communities that need hospital and medical facilities. They are in 43 states, Alaska, Hawaii, Puerto Rico and the District of Columbia. Mississippi and Texas lead with more than 50 each.

Four-fifths, or 308, of the general hospital projects are for new facilities. Of these, 184 have less than 50 beds, 86 have 50 to 100, and 38 provide 100 beds or more. Two-thirds of the new general hospitals are in towns of less than 5,000.

Discussing the cost of the hospitals and health centers before the American Public Health Association in Boston last week, Dr. V. M. Hoge, medical director of the division of hospital facilities, USPHS, said that the practice of comparing costs in terms of beds has little or no value. The cost per square foot, he declared, is the only reasonable basis of estimating and comparing costs.

Cost averages $22 per sq. ft.

On this basis, USPHS now has enough experience with its program to give an idea of the current cost of hospitals and health centers, he said. With all expenditures included, the square foot cost averages about $22. If costs of land acquisition, architects fees and movable equipment are excluded, the square foot cost drops to about $18.

There is considerable uniformity in square foot costs around the country, he reported. In certain areas, contract bid prices are substantially higher than the average, but these situations can be explained, in Dr. Hoge's opinion, by local conditions.

Compton names chairman of geophysics committee

W. E. Wrather, director of the U. S. Geological Survey, last week was named chairman of a Committee on Geophysics and Geography by Dr. Karl T. Compton, head of the Research and Development Board of the National Military Establishment. The committee will meet Dec. 3.

Two former units of the Research and Development Board, one on Geophysical Sciences and the other on Geographical Exploration, are merged in the new committee. The group will study problems in the earth sciences, including weather and climate, strategic minerals, water supplies and contamination, the ocean, its circulation, and the structure of the ocean floor.

Samuel B. Morris, general manager and chief engineer of the Department of Water and Power, Los Angeles, is another of five men so far appointed to the committee. Members to represent the three military services will be named soon.

Report on San Francisco Bay crossing

(*Continued from p.* 39)

Bridge earlier than 1965 can be avoided only at the expense of diverting some peak hour traffic that would normally prefer the bridge to a longer and less convenient route via the southern crossing.

It was concluded that some 82 percent of the transbay traffic will be better served and will prefer a parallel bridge to a southern crossing; 18 percent will be better served by a southern crossing. Estimates of future expansion in all areas on both sides of the bay through 1970 would not change these percentages.

It was also concluded that a southern crossing will induce new transbay traffic from areas which it will best serve. However, the total induced traffic from all areas would amount to less than one percent of the total transbay traffic.

The conclusion was reached that there is no choice between the crossings insofar as congestion on the streets in the downtown section of San Francisco is concerned.

WESTERN APPROACH to the twin bridges, which appear at upper left, would be facilitated by express routes through downtown San Francisco shown here in a scale model. The approach to the southern crossing would start at the traffic interchange shown upper right.

Cost estimates

One of the most important jobs the crossings division had to undertake was the making of cost estimates that could be expected to stand up for a period of one or two years as they will probably be the basis of the revenue bond issue.

In the case of the parallel bridge, cost and quantity determinations could be made with considerable exactness because of the experience gained on the existing bridge. Estimates for the southern crossing could not be developed with quite the same assurance, and this difference was reflected in the estimate of cost by the use of a contingency item of 10 percent of construction costs.

The cost for engineering and administration was assumed at 7.5 percent of the construction cost, based upon the 7.66 percent experienced on the existing crossing.

The total estimated cost of construction for the main crossing of the parallel bridge is $104,255,000 and for the southern crossing $88,351,000. When right-of-way costs and construction costs for approaches on each side of the bay are added, as well as engineering, administration, legal and contingency costs, the cost of the parallel bridge

becomes $155,014,000 and the southern crossing $178,421,000.

Revenue bond financing

The report assumes that either of the additional crossings will be financed by the revenue bond method with the earnings of the existing bridge and the new facility combined to secure the loan. However, if construction costs, retirement of existing debt, and repayment of money loaned by the state to construct approaches are included, the money needed to commence work on each structure is $178,000,000 for the parallel bridge and $193,100,000 for the southern crossing. Each of these figures is greater than the amount that can be raised by revenue bonds. If, however, tolls are raised from the present 25 cents to 35 cents, the upper limit of credit is estimated to be $194,800,000. Thus, the report concludes that three alternatives are available:

(1) Increase the basic toll rate to 35 cents and commence work immediately on the parallel bridge. The estimated completion date is March, 1954.

(2) Retain the present 25 cent toll and wait for a period of 1 year until the existing debt is further reduced and then start work on the parallel crossing. This would delay opening of the new structure until March, 1955.

(3) Increase the basic toll to 35 cents and start work immediately on design and construction of the southern crossing. The new crossing would be completed about September, 1956.

The first of these alternatives was recommended.

The crossings division is a part of the California Department of Public Works, C. H. Purcell, director. Besides Mr. Tudor, key personnel of the division include N. C. Rasb, design engineer of bridges; O. R. Bosso, engineer of surveys; and E. F. Levy, office engineer.

The division retained a board of engineering consultants consisting of George L. Freeman of Moran-Proctor-Freeman & Mueser, consulting engineers, New York; Ralph Smillie, chief engineer of Triborough Bridge and Tunnel Authority; and O. J. Porter, consulting engineer, Sacramento, Calif. Engineering consultants for traffic and finance were Coverdale and Colpitts, New York. They were represented by George W. Burpee.

Important Contributing Factors in Bay Bridge Report

		Construction Parallel Bridge	Priority To Southern Crossing
1.	Date when congestion on present structure will be relieved	March, 1954	Never
2.	Date when both new and old crossing will be inconveniently congested	Not before 1970	1965
3.	Proportion of transbay traffic best served	82%	18%
4.	New traffic induced	None	1%
5.	Additional congestion on city streets	No	No
6.	Two-way bridge traffic discontinued	Yes	No
7.	Mix auto, bus and truck traffic	No	Yes
8.	Most revenue per year		$20,000
9.	Construction cost	$155,014,000	$178,421,000
10.	Annual maintenance and operation cost	$1,772,500	$2,214,100
11.	Earliest date for financing	March, 1950	March, 1951
12.	Time of construction	4 yr.	5½ yr.
13.	Earliest date to open for traffic	March, 1954	Sept., 1956
14.	Minimum toll for financing	25¢	35¢
15.	National defense		Preferable
	Recommended order of construction	1	2

**All dates, amounts, etc. are estimates.*

County's Hoover Dam claim denied by Nevada court

Nevada's Supreme Court has ruled that Clark County, which includes Las Vegas, shall have no share in the $300,000 annual Hoover Dam payment made by the United States government to the state of Nevada.

The decision was the second defeat suffered by Clark County officials in their long legal battle to share in the returns from the project.

The $300,000 payment, over a 50-year period, was approved by Congress in the Boulder Canyon Adjustment Act of 1940, and in 1941 the Nevada legislature awarded to Clark County a 20 percent share in the money because Hoover Dam lies partly within the county's borders. Two years later the lawmakers took away the Clark County share, leaving the entire $300,000 to the state of Nevada.

That action was protested by the Clark County officials and in 1945 the legislature passed a law permitting them to sue the state.

In 1946 Judge Clark J. Guild in Carson City ruled that Clark County has no right to share in the revenues because the money represented a payment made to the state as a whole and not for the benefit of any particular subdivision.

Clark County contended that the money represented funds which could have been collected in taxes had the power project been constructed by private interests; and that both the state and the county have the right to tax not only the dam and power plant, but also the electrical energy produced, the privilege of producing such power, and the transmission of the electricity.

In its decision Oct. 29 the Nevada Supreme Court expressed no opinion on the latter contention. The United States Supreme Court, however, has repeatedly ruled that the government cannot be taxed by a smaller subdivison.

Vast irrigation projects proposed for Nebraska

The preliminary draft of the Bureau of Reclamation's proposed report on the development of the Lower Platte River basin calls for large irrigation projects in Nebraska.

The plan as made public by Governor Val Peterson outlines methods of bringing irrigation water to about 1,411,000 acres of irrigable land in the North and South Platte drainage areas and all the territory tributary to the Platte, Loup and Elkhorn rivers. Capital costs are estimated at more than half a billion dollars.

The plan represents several years of field surveys directed by Paul Harley, the bureau's district engineer at Grand Island, Neb. Public hearings probably will be held on it to provide opportunity for full discussion for the guidance of the bureau and its commissioner before presentation to Congress.

HEAVY FREIGHT being unloaded in New York City is a 130-ft., 92-ton plate girder for the East River Drive. Fabricated in Bethlehem Steel Co.'s Pottstown, Pa., plant it required three Pennsylvania Railroad flat cars for the trip to New York.

State planning board proposed in North Carolina

Steps toward the establishment of a North Carolina State Planning Board were taken at a recent meeting, at Chapel Hill, of 125 city managers, mayors and planning specialists.

The board is to be established on a permanent basis with emphasis on technical assistance and consultant services for local communities.

A committee composed of City Manager Robert W. Flack of Durham, George Watts Hill of Durham, and Benjamin Cone of Greensboro, with John Sprunt Hill of Durham serving as consultant, was named to consider ways and means of establishing such an agency. John A. Parker, head of the Department of City and Regional Planning at the University of North Carolina, is to serve as executive secretary of the group.

City Manager Flack of Durham said that in many municipalities in the state lack of planning has made obsolete about 65 percent of all capital investment over a period of years.

Plan revived to harness Passamaquoddy Bay tides

The International Joint Commission is reported to be reviving studies of a $100 million plan to harness the tides in Passamaquoddy Bay on the Maine-New Brunswick border.

The commission, which has jurisdiction over Canada-United States boundary waters, will undertake a limited review without committing either country to a full investigation.

U. S. Senator Owen Brewster of Maine, has been pressing the State Department for months to start an investigation on the prospects of going ahead with the development.

As originally proposed in the 1920's the project called for developing some 3,000,000 kwh. of electricity per year through harnessing the great tidal range of the Bay of Fundy. It would involve damming Passamaquoddy Bay, on the border, and Cobscook Bay, wholly within Maine.

S. W. Trafficway project in Kansas City to start

Start of construction of the long-delayed principal link at Kansas City, Mo., of the $5,000,000 Southwest Trafficway project is scheduled for an early date. Bids for construction of the ½-mile long 6-lane viaduct located west of the Union Station were received by the State Highway Department.

Work on the project was started in 1941 when two rigid frame grade separation structures were constructed to the north of the main viaduct. The post-war part of the project will involve, in addition to the main viaduct, construction of viaduct approaches and elaborate traffic interchange facilities in Penn Valley Park to the south of the main viaduct. It is expected that all work will be under contract in 1949.

The project is under the general supervision of the Missouri State Highway Department. Howard, Needles, Tammen & Bergendoff, consulting engineers, of Kansas City, have been retained for design of the main viaduct and the traffic interchange structures.

MAJOR MEETINGS

Black Top Roads Association, Springfield, Ill., Dec. 2.

Society for Experimental Stress Analysis, annual meeting, Hotel Commodore, New York City, Dec. 2-4.

Southeastern section American Water Works Association, Sheraton Bon Air Hotel, Augusta, Ga., Dec. 6-8.

Highway Research Board, National Academy of Sciences and National Research Council, 2101 Constitution Ave., Washington, D. C., Dec. 7-10.

National Society of Professional Engineers, annual meeting, Sherman Hotel, Chicago, Ill., Dec. 15-18.

CONSTRUCTION ACTIVITY

CONTRACT VOLUME

Continental U. S. Only

(Millions of Dollars)

	Week of Nov. 25 1948*	Cumulative 1948 (48 wks.)	Cumulative 1947 (48 wks.)	% Chge
Federal	$5.1	$879	$570	+54
State & Mun.	43.1	2,421	1,691	+43
Total Public	$48.2	$3,300	$2,261	+46
Total Private	32.6	3,076	2,895	+ 6
U. S. Total..	**$80.8**	**$6,376**	**$5,156**	**+24**

*4-Day Week

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Millions)

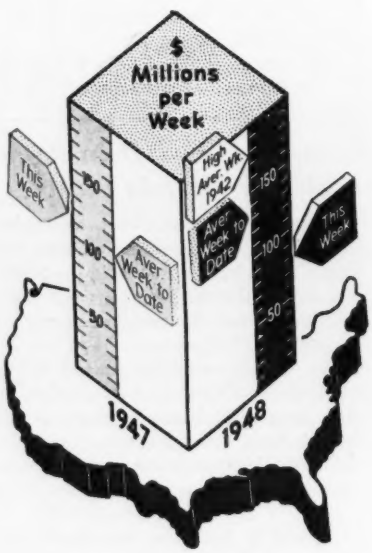
Type of Work	This Week	Cumulative 1948 (48 wks.)	Cumulative 1947 (48 wks.)	% Chge
Waterworks.	$7.5	$184	$177	+4
Sewerage ..	1.8	204	202	+1
Bridges	6.8	266	260	+2
Highways ..	12.8	927	914	+1
Earthwork, Waterways.	4.4	475	470	+1
Buildings, Public	13.5	1,042	1,029	+1
Industrial .	7.9	1,026	1,018	+1
Commercial	16.4	1,670	1,653	+1
Unclassified.	9.7	582	572	+2

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (48 wks.)	Cumulative 1947 (48 wks.)	% Chge
NON-FEDERAL ..	N. A.	$2,286	....
Corporate Securities	N. A.	963	....
State and Municipal	N. A.	1,075	....
U. N. Building Loan	65	....	....
Fed. Aid Highway	427	248	+72
FEDERAL	1,559	819	+90
Total Capital ..... N. A.		**$3,104**	....

N. A.—Not Available



As Reported this week to . . .
Engineering News-Record

ENR INDEX NUMBERS

Index Base = 100	1913	1926
Construction Cost ..Nov.'48	478.25	229.89
Building Cost .....Nov.'48	355.86	192.37
Volume .....Oct.'48	291	128

Manila airport job goes to contracting combine

Construction of a modern runway at Manila International Airport has been called for in a contract entered into by the Philippine and United States governments with Marscon Inc., a Philippine corporation formed by Morrison-Knudsen, Inc., of Boise, Idaho, and Marsman and Co., a Manila construction firm.

The new runway will be constructed of hot mix asphalt on a concrete base. It will be 7500 x 200 ft., with a 5500 x 80-ft. taxiway and an 800 x 400-ft. apron. The existing runway will be extended 1850 ft. to meet the new runway; the existing taxiway will be extended 4000 ft. to a junction with the new taxiway; 2000 ft. of paved access highway will be constructed.

Terms of the contract were not immediately announced.

The Manila International Airport was formerly Nichols Field, a U. S. Army fighter base from 1921 to the outbreak of World War II. The field was wrecked in the first days of the war by a Japanese bombing attack. The invading Japanese with the aid of forced Filipino and American prisoner of war labor built an elaborate concrete landing system which was taken over and enlarged when the Americans liberated Manila early in 1945. The field was reverted to Philippine control in 1947. Increasing difficulties have been caused by heavy planes which are proving too much of a burden for the light concrete runway.

Runway construction is part of a program of the United States Civil Aeronautics Administration for the rehabilitation of Philippine airway facilities under the terms of legislation passed by Congress in 1946.

A good $6,000 house needed, says HHFA head

Speaking at the recent Seattle meeting of the National Association of Housing Officials, Raymond M. Foley, administrator of the Housing and Home Finance Agency stressed a need for low cost housing.

Mr. Foley asserted that industry, labor and government should aim toward a good $6,000 house, for unless this low cost structure is produced, a serious drop in production will occur.

To award contract soon for Tecolote Tunnel

A contract for the Tecolete Tunnel, first unit to be constructed in the Santa Barbara, Calif., domestic and irrigation water project, will be awarded about Feb. 15, 1949.

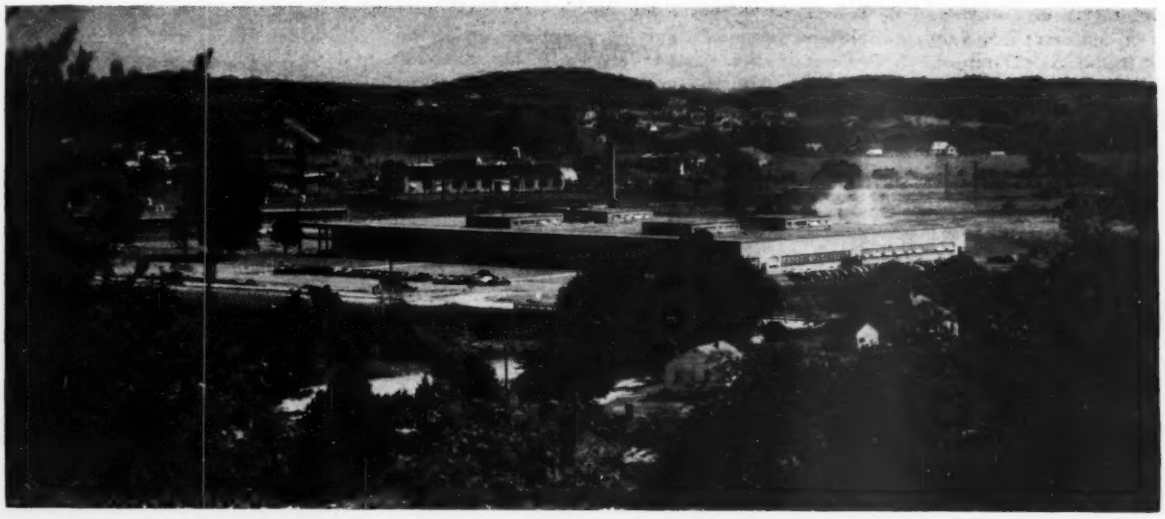
The estimate by Bureau of Reclamation engineers on cost of the 6-mi., 6-ft. diameter tunnel is $4,080,000. Although only $2,600,000 is available to date for the project, the contract will be let for the entire job.

Because of the threatened water shortage in the Santa Barbara area, work on the tunnel will be started on the city side in the hope that it can strike underground supplies which can be utilized next year.

The tunnel is part of a $32,310,000 construction program which also includes Cachuma Dam ($17,495,000), a conduit to take water from the tunnel to Santa Barbara, Goleta, Montecito, and Carpenteria, and lateral distribution systems.

Spokesmen for the bureau regional office in Sacramento say they hope to be able to award a dam contract sometime in 1949.

Factory: Seven months from sketch to production



Construction speed was the answer to the construction cost problem given by The Austin Company in building this 127,000-sq. ft. plant at Salem, Va. The flat-roofed Yale and Towne Mfg. Co. factory went into production within seven months from the day preliminary sketches were submitted.

Designed and built for approximately $1,000,000, the new specialties division lock plant replaces facilities formerly at Stamford, Conn.

The low, sprawling plant covers nearly three acres of its 24-acre site. Simple, flat-roofed, beam-and-column construction was achieved by complete reliance on artificial lighting. Continuous fluorescent lighting has been installed throughout the 108,000-sq. ft. manufacturing area.

Ventilating fans installed in the roof and a duct distribution system have been designed for alternate use as heating and cooling aids.

With future expansion in view the temporary east end wall has been built of concrete block; other exterior walls are of brick.

The structural steel frame is built on columns at 30 by 40-ft. spacing. A welded steel roof deck with 1½ in. fiber glass insulation is covered with built-up roofing.

MEN AND JOBS

C. S. Mullen, chief engineer for the Virginia Department of Highways, recently completed 40 years of continuous service and was presented with a 40-year service pin at a luncheon given by department officials in his honor. **A. H. Pettigrew,** right-of-way engineer, only other official to wear the 40-year pin, made the presentation.

Harold A. Stepleton has announced the opening of engineering offices in the name of H. A. Stepleton & Co., Suite 624, Spitzer Bldg., Toledo 4, Ohio, to specialize in water, sewer treatment and sewage and refuse disposal plants.

Leslie McNeil, Vancouver, B. C., has been appointed city engineer at Merritt, B. C., succeeding Lewis Clark, who held the post for the last 22 years.

John G. Wallace, associated with the Nickel Plate Road for 30 years and chief engineer since 1942, has been promoted to general manager. He received his engineering degree from Pennsylvania State College. He was assistant engineer with the Chicago, Milwaukee, St. Paul and Pacific R.R. Co. for four years before he was appointed, in 1918, as engineer of structures for the Lake Erie and Western Railway, which later was consolidated with the Nickel Plate. He was appointed chief engineer of the system in 1942. Mr. Wallace succeeds **A. R. Ayers** who is retiring after nearly 50 years of railroad service, including 32 years with the Nickel Plate. **H. M. Whitmore,** assistant to the chief engineer since 1945, has been appointed to succeed Mr. Wallace as chief engineer.

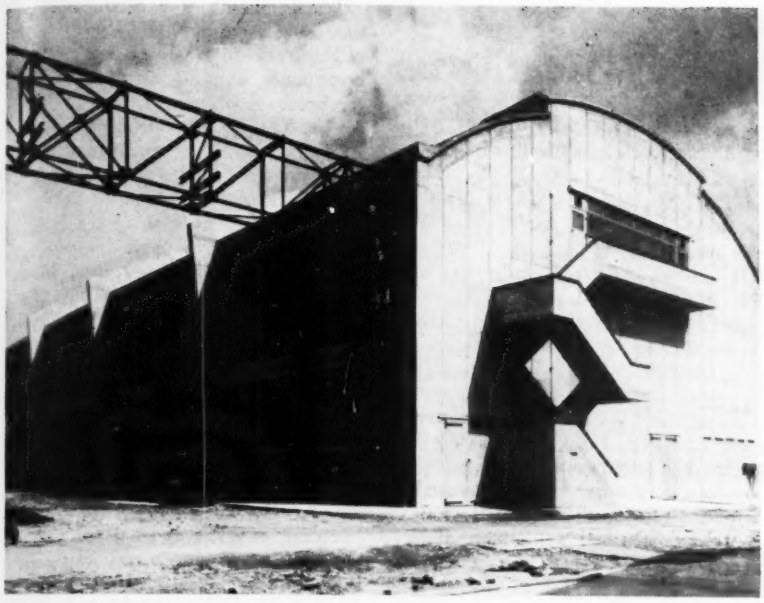
On right of the Bull Shoals sign, from left to right, are U. S. Congressman W. F. Norrell for the 8th District of Arkansas, who is a member of the Appropriations Committee of Congress; Col. T. A. Lane, Corps of Engineers, Little Rock district engineer; Mr. Ralph P. Johnson, Corps of Engineers, engineer in charge of Bull Shoals Dam project. On left of sign, right to left, Maj. W. J. Klasing, Corps of Engineers, temporarily assigned to the project; and M. H. Slocum, superintendent for the Ozark Dam Constructors, the prime contractors.

James T. Hanie has been appointed resident engineer at Plant Yates, the new $21,000,000 steam-electric generating station of Georgia Power Co. now being constructed on the Chattahoochee River near Whitesburg, Ga. Mr. Hanie has been resident engineer at Plant Atkinson where a new 60,000 kw. addition is under construction.

J. Burch McMorran, of Rochester, has been appointed chief engineer of the N. Y. State Public Works Department to fill the vacancy caused by the promotion of B. D. Tallamy to superintendent of the department. Mr. McMorran, a veteran of both wars, entered service in the department in 1921. Latterly he has been district engineer in the Rochester office.

Members of the South Carolina and Georgia Sections of the American Society of Civil Engineers took a day off to visit the multi-purpose Clark Hill project on the Savannah River near Augusta, Ga. Left to right: Ted Neelands, concrete technician; Ray Pierce, secretary A.S.C.E.; C. P. Linder, vice-chairman A.S.C.E. and chief engineer of South Atlantic District of Corps of Engineers; Porter Van Enloe, Atlanta, Ga., president of Georgia Section A.S.C.E.; Thomas Evans, chairman of program committee and dean of Civil Engineering School, Georgia Institute of Technology; Grady L. Bain, resident engineer, and Fred Marane, assistant resident engineer, Corps of Engineers, Clark Hill project.

Helping New York City catch up with its water needs, is Frank Musso, division engineer for the Board of Water Supply at Neversink, N. Y. Neversink Dam, barely begun before the war interrupted work, will be completed in 1952. It will impound the first Delaware River water to be carried to New York by the Delaware Aqueduct.



ARCHITECTURAL TREATMENT of this chemical plant in Essex, England, was intended to express frankly use of concrete rigid frame and barrel-arch construction. Some stairways also are on the outside.

Flexible Factory with Exposed Frame

Designed for freedom of arrangement of the plant within its walls, this reinforced concrete chemical factory in Essex, England, features a barrel arch shell roof and rigid frames on the exterior of the building.

Required to house chemical manufacturing activities on the property of May and Baker, Ltd., the 144-ft. by 64-ft. structure also includes laboratories and administration offices.

The single span reinforced concrete shell roof is 2½ in. thick, and receives its stiffness from the rigid frames, Longitudinal reinforced concrete purlins carry the two continuous skylights which run the length of the building. These purlins also support removable flat slabs provided for upward plant extensions, and on them is hung a ventilation duct running the building's length.

The plant's operating floor is a reinforced concrete slab carried on structural steel framework. All plant floors are paved with checkered tiles and are sloped to acid resistant stoneware drainage channels, covered by removable cast iron gratings.

Plant will be erected on the ground floor as well as the upper elevation. A light mezzanine floor will be erected between the two levels as future plant expansion demands. The foundation has been designed for this expansion.

Two five-ton traveling cranes ride rails the length of the building—one on each side—for the purpose of installing and removing plant equipment.

Corrosion-resistant materials used

In view of the atmosphere of a chemical factory, materials likely to suffer from corrosion have been avoided, and, where this is impossible, careful protective measures have been taken to reduce maintenance costs. Rain water pipes are cast iron and are embedded in the reinforced concrete columns of the rigid frames.

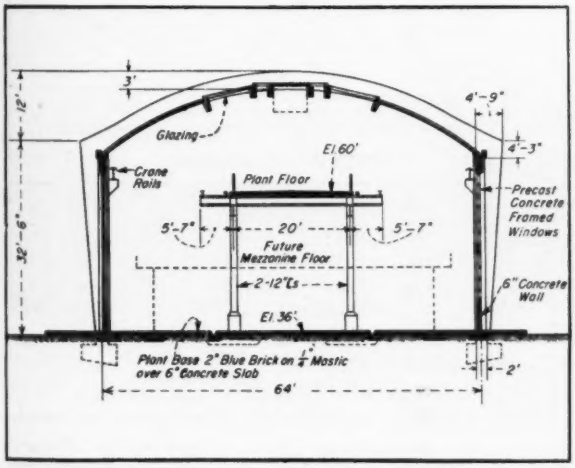
All large concrete wall surfaces have vertical vee joints at regular intervals to reduce surface staining, and the concrete has been left in its natural color after rubbing down.

Walls are reinforced concrete with concrete framed windows almost the full height of the building on two sides.

Emergency exits are provided at all floor levels and communication is by means of external and internal staircases, as well as elevators of one-ton capacity. External staircases and balconies are reinforced concrete.

The building is surrounded by a concrete pavement for the storage of raw materials prior to use or for operations which can not be safely carried out in an enclosed space.

Architect on the job was Edward D. Mills of London. Engineering was done by the Barrel Vault Roof (Designs) Ltd., also of London. Work was carried out under a single contract awarded to the London firm, Holland & Hannen and Cubitts, Ltd.



BARREL-ARCH ROOF construction and exterior rigid frames permit maximum interior space for plant layout. The shell roof is 2½ in. thick.

CONTINUOUS SKYLIGHTS, framed by concrete purlins and the rigid frames, admit light to the operating floor. Traveling cranes facilitate plant operations.

France resumes deep jetty construction at North African naval base near Oran

In 1949, full scale construction operations will be under way on the second of two main deep water jetties to inclose Mers-el-Kebir bay, site of the new French Mediterranean naval base near Oran, Algeria.

The 1.1 mile north jetty, begun in 1935, was substantially complete, and preparations were under way for the 1.55-mile East jetty in mid-1940, when the fall of France caused suspension of work. Many Americans who fought in North Africa debarked at Mers-el-Kebir and saw the port in its half-completed stage.

Postwar East jetty preparations, including some jetty foundations, fill for a work port, installation of construction machinery and development of nearby quarries, will be complete by the end of this year.

When finished, the Mers-el-Kebir base will have a 1.35-sq. mile harbor, protected on the land side by mountainous peninsulas and on the sea side by the jetties and a breakwater extension to the north jetty. Together with shore-side quays and moles, the jetties will furnish 4 miles of mooring space for ships of draft up to 40 ft. Drydocks also are included in the project.

Both jetties are built on hard bottom 80 ft. to 100 ft. deep. The north jetty cross-section is shown on the map insert. Precast concrete blocks weighing about 100 tons each form a nearly vertical mooring wall on the inshore side; blocks also form the outshore finish, as shown. Experience with the north jetty has shown that the top layer of outshore blocks has a tendency to slip, so the corresponding finish on the east jetty will be formed of a single layer of 325-360 ton blocks, plus rocks of 9 to 16 tons.

Shore work for the north jetty centered around the block quay, on which blocks for that jetty were cast. Fill rocks and aggregate from three quarries were brought to the waterside by various means. Material from nearby Viaduct quarry was carried in narrow-gage cars. Cap Gros rock was carried by truck, underground railway, or, after crushing at the quarry, by a two-cable telpherage to 1,550-cu. yd. silo No. 1. Aggregate crushed at Santon quarry was transported down to 1550-cu. yd. silo No. 2 by a 5,900-ft. telpherage system at a rate of 50 tons per hour. Large fill rocks were trucked.

Dump cars containing medium-size fill materials were hoisted by a special seaside gantry crane and dumped directly into barges. Large rocks were sling-handed into barges by two 10-ton quay cranes.

The silos fed out materials in three ways: from automatic batching hoppers under the silo onto a belt conveyor which charged narrow-gage cars supplying the block plant; from hoppers on the land side of the silo into trucks for various other sites, and from a seaside hopper onto a rolling articulated belt conveyor which fed into barges or into the silos of a floating concrete plant.

Block making was conducted with the following plant, all operating on rails parallel to the bulkhead line: concrete mixer, a gantry carrying a bucket for concrete placement, and a gantry for handling forms and finished blocks. A special shunting arrangement enabled the two gantries to exchange relative positions.

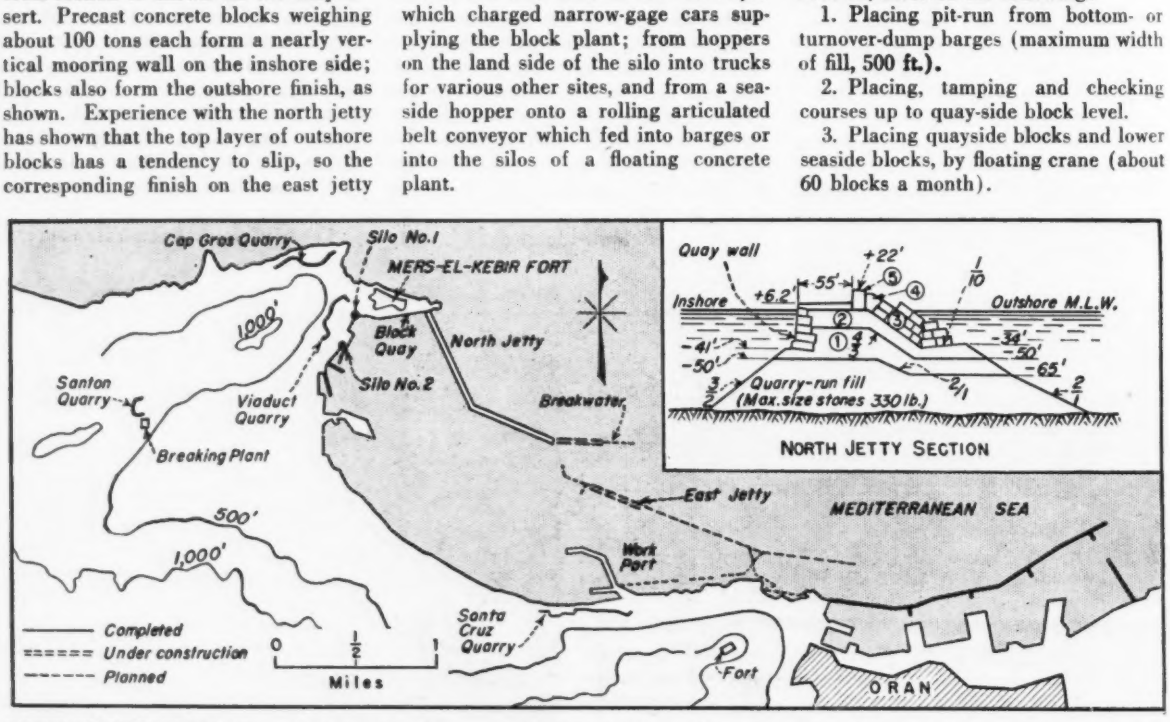
Cement and aggregates were brought by rail to the mixer and dumped into the skip. Sea water was used in the mix, which was dropped into the gantry bucket for placement in demountable steel forms. A 52-cu. yd. block containing 40 mixes was produced each hour. Finished standard blocks were loaded onto barges by the second gantry, and special blocks were loaded by a 150-ton floating crane.

The floating concrete plant, a 104-ft. vessel carrying bins, conveyors and a 34-cu. ft. mixer, was used for placing the deck, guard wall and key block. One other significant piece of equipment was used. It was a 250-ton travelling hammerhead revolver crane which worked from the jetty deck during construction. This crane could set the outermost blocks, a 100-ton load at a 114-ft. reach.

Construction procedure

Construction of the jetty, proceeding simultaneously along a length of about 1600 ft., involved the following:

1. Placing pit-run from bottom- or turnover-dump barges (maximum width of fill, 500 ft.).
2. Placing, tamping and checking courses up to quay-side block level.
3. Placing quayside blocks and lower seaside blocks, by floating crane (about 60 blocks a month).



PORT PROTECTION—Two jetties will, when completed, protect Mers-el-Kebir naval base from the Mediterranean Sea. Location of quarries and waterside construction plant sites is shown. Contours 500 and 1000 ft. above sea level indicate the mountainous terrain. Cross-section of north jetty (insert) shows the following components: 1. 330-3300-lb. material; 2. 3300-lb. and over; 3. 100-ton concrete blocks; 4. key block; 5. guard wall.

FLOATING CONCRETE PLANT and hammerhead crane team up to place north jetty key block concrete, formed between top-layer outshore blocks and guard walls.

4. Placing the remaining rocks, by floating and hammerhead cranes, the latter at 160-ft. reach.

5. Concreting deck and guard wall foundations.

6. Laying hammerhead crane rails.

7. Placing upper seaside block layer by hammerhead.

8. Concreting guard wall and key block.

North jetty work required 5,800,000 tons of rock and 1,000,000 cu. yd. of concrete. Still greater quantities are estimated for the east jetty: 11,000,000 tons of rock and 1,470,000 cu. yd. of concrete.

Similar equipment, save for the hammerhead crane and the floating concrete plant, has been used in building the north breakwater and the quay installations behind the north jetty.

Eastern jetty

For the eastern part of the harbor installation, on the other hand, the first job was construction of a work-port for protection against the roughness of the sea.

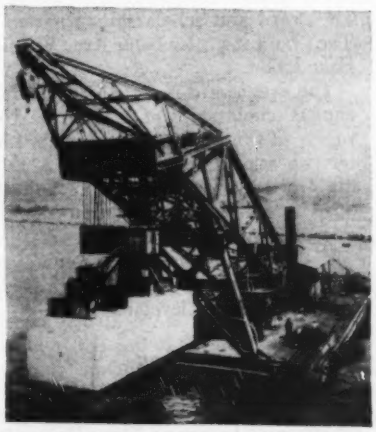
This was begun in 1940 and because of lack of work force, materials, fuel, etc., was only recently completed. Also, to serve as a breakwater for the work-port, the foundation of the east jetty has been laid for about 1600 ft. up to a height of 25 to 30 ft. below sea level. In general, however, work on the east jetty is now only nearing the end of the preparatory stage.

The work-port itself forms a harbor of some 30 acres. It consists of two jetties, the outer one of 2700 ft. and the inner one of 2200 ft., lined with concrete block. A mole links the two, and a considerable working area has been filled in along the shore. These installations, which required 2,500,000 tons of rock, will be used as quays in the finished port.

At the inner work-jetty, concrete blocks of 325-360 tons will be lifted by a 400-ton capacity floating crane onto barges. The barges will carry them to the proper spot on the east jetty, where the floating crane will lift them again and place them, aided by divers.

Several quarries have been opened just behind and beside the work-port, capable of providing 15 to 18 million tons of rock. Extraction methods and equipment are largely similar to those employed in the north jetty work. Rock is descended by a double gravity funicular of 5,000 tons daily capacity. A 500 ton-per-hour gravity crusher now is being installed. A 145-ft. high concrete plant comprising three 53-cu. ft. mixers will be erected.

Material for this feature is drawn from a series of articles in the French review, TRAVAUX, by the principal contractors at Mers-el-Kebir; and from M. Alain Pavin, INGENIEUR EN CHEF DES TRAVAUX MARITIMES, in charge of the project for the French Navy Ministry.



400-TON FLOATING CRANE lifts an east jetty block. These blocks, now being cast, weigh three times as much as those of the north jetty.

Invasion pontoon jetty in use on Thames River

Two pontoons used for Operation Whale at Mulberry harbor during the Normandie invasion have recently been put to use off Frog Island in the Thames River, England, in a new installation for the discharge of cargoes from ocean-going ships.

As a part of Mulberry harbor, one of the pontoons was passed over by 7,000 vehicles during a critical 24-hour period of the invasion. The remaining 21 pontoons which made up the wartime jetty have been sold for harbor installations at Malta, Dakar and Gdynia and in Iceland and Finland.

Frog Island in the Thames lies within the jurisdiction of the Port of London Authority, which granted license to the Phoenix Timber Co., Ltd., for erection and operation of the pontoon structure.

The floating jetty, formed by two pontoons placed end to end, measures 400 ft. in length and is 60 ft. wide. A bridge 240 ft. long connects the jetty with the mainland. Seven four-ton anchors hold the pontoons in place against timber dolphins.

Basic use of the pier commercially is the same as its use during the invasion. Cargo is taken from ships and loaded directly on trucks or rubber-tired trailers for transport to yards for distribution. Many surplus British and U. S. Air Force trailers have been obtained for operation at the jetty.

Surveys made on the installation and the river have brought forth the conclusion that vessels drawing up to 21 ft. of water can be handled at the pier while afloat, and those drawing 28 ft. can be unloaded while partially supported on silt.

New sea wall at Pett

Also in England, a new sea wall nears completion at Pett on the Sussex coast. Essentially a clay wall, with steel sheet piling, concrete blocks and asphalt as protection from wave action, this $2,000,000 structure will re-use all excavated material and carry a new stone-paved road on its landward side.

Sufficiently completed to bear the brunt of next winter's stormy waters, the wall is expected to be finished as soon as the road is paved. This will be accomplished some time next year, according to present indications.

ENGINEERING SCHOOLS

Dean Wessman urges wider background for engineers—75 years of civil engineering at Notre Dame—Faculty changes

Engineering students should have a wider background in English, history and economics in addition to technical training, Harold E. Wessman, new dean of the University of Washington college of engineering, believes.

"Too many engineers become highly proficient in their own technical fields, but sadly lack fundamentals and interest in everyday problems and culture," Dr. Wessman said, in taking up his new work at Seattle. "This is because many colleges give engineers practically no background in non-technical subjects."

The humanistic-social department of the engineering college was developed last year after a national survey showed graduate engineers lacked sufficient background in economics, political science, literature and other allied fields. Condensed but adequate courses from economics to music appreciation are offered.

Dr. Wessman, for eleven years head of the civil engineering department of New York University, succeeds Prof. Edgar A. Loew, who remains as dean emeritus and professor of engineering.

Notre Dame Anniversary

This year marks the 75th anniversary of the beginning of civil engineering instruction at the University of Notre Dame. In the catalog of 1872-73 appeared this announcement: "Civil Engineering: This important branch study will be commenced next session and will afford our advanced students the opportunity long desired of fitting themselves for important professions in life." Also: "Those desirous of admission to this course must, if not graduates of the scientific course, pass satisfactory examination in the mathematics and physical sciences of that course."

The curriculum announced consisted of two years work after admission to the course. The courses in drawing covered isometric and linear perspective, topographical drawing, machine and architectural drawing, and plans and elevations of engineering constructions. Under the heading of applied mathematics was to be taught analytical mechanics, astronomy, descriptive geometry and geodesy; Rankine's "Civil Engineering" was studied, also Morin's "Traite d'Hydraulique"; and lectures on resistance of building materials, and on roads and bridges were given.

Succeeding catalogs said that "This important branch of study has been inaugurated with success" and "is now thoroughly established." Prof. Arthur J. Stace, A.M., previously professor of surveying and assistant in Greek and English, was the first professor of civil engineering. The catalog of 1874-75 listed four members of the faculty of civil engineering.

Appointed director of the school of hydraulic engineering at Louisiana State University is Cecil S. Camp, right. Assistant professor of that subject is James F. Halsey, left.

The first degree of Civil Engineer was conferred in June, 1875 on Cassius M. Proctor, Elkhart, Ind. Until 1886 only two more C.E. degrees were conferred. From then on the department grew more rapidly. This year the enrollment in the engineering college is 1,162, of which 132 are in civil engineering. There will be 25 graduates in this year's class.

Scholarship Program

Next April 1 is the closing date for the 1948-1949 engineering undergraduate award and scholarship program of The James F. Lincoln Arc Welding Foundation.

The first award is for $1,000 for four annual scholarships of $250 at the University of Cincinnati; the second is $500 for two annual scholarships at $250 at the University of Minnesota; and the third is $250 for one annual scholarship at Iowa State College.

Full information may be obtained from The James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

Faculty Changes

Cecil S. Camp has been appointed director of the school of hydraulic engineering at Louisiana State University to succeed Glen N. Cox, who has gone to New York University. Professor Camp has taught at Oregon State College, Mississippi State College, Syracuse University, and since 1941, has been in charge of hydraulic and sanitary engineering courses at the University of Tennessee. Other experience has included work in hydraulic and sanitary engineering with the Tennessee Valley Authority, the U. S. Engineer Department, and Greeley and Hansen, consulting engineers. James F. Halsey is now an assistant professor of hydraulic engineering, after having received the M. S. degree there in August 1948. He was the first fellowship student to participate in the educational program which Louisiana State University is carrying out in cooperation with the U. S. Waterways Experiment Station. The school of hydraulic engineering has seven of these research fellowships available each year.

Grimes G. Slaughter, Jesse H. Wilder and David Rabin have been added to the faculty of the Duke University school of engineering at Durham, N. C., as instructors of engineering.

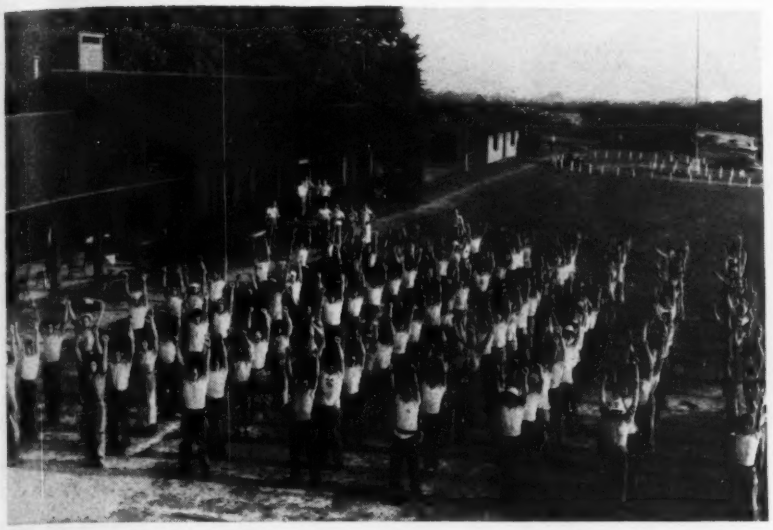
Prof. John J. O'Neill, dean of the faculty of engineering at McGill University, Montreal, has been appointed vice-principal of the university.

Prof. Morrough P. O'Brien, Dean of the College of Engineering, University of California, has returned to the Berkeley campus after a year's leave of absence spent in private industry. During the year he served as director of research and engineering for the Air Reduction Co., heading construction work totaling $15,000,000. He also directed a reorganization of the technical phases of the company's activities and formulated technical plans and policies.

These staff changes in the department of civil engineering of the University of Illinois has been announced by Prof. W. C. Huntington, department head: F. A. Reickert, whose degrees are from Rensselaer and Yale, has been named associate professor. Robert R. Philippe, graduate of M.I.T., and R. N. Bergendoff, graduate of the University of Pennsylvania, will serve part time as lecturers in foundation engineering and structural engineering respectively. C. T. Bagley, graduate of the University of Tennessee, is part-time visiting assistant professor. New instructors are J. W. Briscoe, D. A. Day, and G. A. Young. Promoted to associate professors are E. E. Bauer and G. H. Dell; to assistant professors, C. P. Atkins, J. C. Guillou, and T. H. Thornburn; to instructor, J. W. Seyler; to research associate, W. J. Austin; and to special research associate, H. O. Ireland.

John A. Ross, Jr. retired Oct. 1 as president of Clarkson College of Technology, Potsdam, N. Y., after 37 years of service with the institution. He is succeeded by Jess H. Davis.

Random Lines *from an editor's notebook . . .*



. . . Recording activities at Camp Case in Mohican State Forest Park, Ohio—biggest summer surveying camp in the country

Reveille at 6:30 a.m., roll call and calisthenics at 6:45 were the first orders of business at the Case Institute of Technology summer camp, near Loudonville, Ohio, where 384 students received two weeks' intensified training in elementary surveying and mapping this past summer. Last year's enrollment totaled 552—largest in the history of the 40-year old camp and representing the biggest summer surveying camp in the country.

Chief reason for the large summer camp is that Case believes in giving all its male students an indoctrination course in surveying and mapping regardless of whether they intend to be civils, mechanicals, chemists, electricals, or are enrolled in any of the other technical courses offered by the institute. Most of the students attend camp either during or following their freshman year. The sophomore civils, however, return for an additional two weeks' camp involving an advanced problem in highway location.

Camp held in three sections

The summer camp, held each year since 1907, usually is divided into three sections to cause as little interruption as possible in the student's summer vacation and to give a maximum of personalized attention by the instructors. The first section is held in June so students can attend before going home for the summer. The second and third sections are held consecutively during the latter part of August and the first week of September. This permits students in the third section to take their camp just prior to fall enrollment. Regardless of the size of each section, enough instructors are assigned to the camp so as to have one for each 16 students. The students work and study in parties of four.

A great deal of surveying training is crowded into each section of the camp, which runs 14 days with one Saturday afternoon and one Sunday off during the middle of the two-weeks period. About 20 field problems are included in the course. They involve triangulation observing, taping, differential, profile and double-rodded leveling, passing an obstacle, obtaining the height of an insurmountable object, computation of areas, traverse reconnaissance and survey, and transit stadia topographic mapping. The care and use of surveying equipment is stressed at all times.

The topographic mapping of an assigned section of the Mohican State Forest, to a scale of 1 in. equals 50 ft. with 5-ft. contours, is the final problem for each four-man party. Data from each topographic survey are transferred to a master tracing, to a scale of 1 in. equals 200 ft. with 10-ft. contours, and at the end of the camp period blueprints of the completed topographic map are given to the Ohio Department of Forestry. Estimated value of this map, which covers about 300 acres each year, ranges from $1,500 to $2,000.

A typical day's routine includes the previously mentioned 6:30 a.m. reveille, roll call, and calisthenics followed by breakfast at 7. Quarters then are policed and general assembly is at 8. Classroom lectures and field work last from 8 to 11:30 a.m. at which time "recall" is sounded over the camp loudspeaker, with lunch at noon. Field work is resumed at 1 p.m. and continues until the 5 p.m. recall, followed by dinner at 5:30. Competitive camp sports such as soft ball, horseshoes, volley ball, ping pong and badminton follow dinner, with taps at 10 p.m.

Permanent camp facilities

Ten years ago Case established its summer camp in the Mohican State Forest and built $45,000 of permanent buildings. Occupation of the site is through contract with the Ohio Department of Forestry.

Most of the buildings at Camp Case are timber-framed, of Oregon fir, with cedar shingles and log cabin siding. They include: a 120x30-ft. mess hall with a maximum seating capacity of 264; a 30x24-ft. kitchen adjoining the mess hall with walk-in mechanical refrigerator; a 70x35-ft. lodge hall with two 48x24-ft. open-wing pavilions; a 72x14-ft., 48-man barracks; a 60x14-ft., 40-man barracks; a dispensary with four small hospital units; a 32x16-ft. administrative building; cabin quarters for 36 faculty; a 24x16-ft. sophomore computing and drafting hall; and two bath houses and toilets.

In addition, there are a 48x24-ft. fireproof instrument hall and a 13x13-ft. pumphouse with a deep-well pump. Students not assigned to barracks are housed in four-man 14x12-ft. tents with 42-in. sidewalls and a "sod-cloth" tarpaulin floor. All permanent facilities have electric lights, while each student bunking in a tent is issued a kerosene lantern. A large portion of the students apparently prefer the tents to the well-kept barracks.

G. Brooks Earnest, professor of civil engineering, Case Institute of Technology, is director of Camp Case. Professor L. R. Lowe of the English department is in charge of the commissary and Dr. W. E. Rees is camp physician and director of recreation.

Other faculty members serving as camp instructors include: C. W. Wallace, J. T. Owen, P. Keller, P. E. Guenther, A. E. Bradley, J. A. Wilson, L. J. Green, E. G. Rapp, H. H. Landon, C. B. McIntosh, M. L. Granstrom, and C. Cicirello.

Each student attending camp is charged $51.50; some $31 of which is allotted for food. Successful completion of the 14-day camp carries a 2-hr. credit in preliminary surveying and mapping.—J.R.C.

Compact but efficient pipe-casting plant makes five huge pipe per day for . . .

New 150-mgd. Intake at Cleveland, Ohio

CASTING FIVE SECTIONS of reinforced concrete pressure pipe per 8-hour day for the Nottingham Intake at Cleveland, Ohio does not appear to be an imposing schedule until the size of pipe, tonnage of reinforcing and volume of concrete required to make a single section are considered.

Then the picture changes: The pipe in question are being cast at Wildwood Park, northeast of the city, to form the 18,500-ft. lake section of the new intake. They are 24-ft. long, 10-ft. inside dia., with a wall thickness of 10 in., and weigh 50 tons each.

Each section contains 25 cu. yd. of 4,500-psi. concrete, and 3 tons of steel reinforcement in three cages—two circular and one elliptical. The circumferential reinforcement is $\frac{1}{2}\frac{7}{2}$-in. steel rod. All three cages are formed on a single mandrel, spirally wrapped and tack-welded to $\frac{3}{8}$-in. longitudinal bars to form one rigid cage of reinforcement.

The most logical site for the casting plant was a triangular shaped 6-acre area between Euclid Creek and Lake Erie. It lies adjacent to a large shore shaft which will form a junction between the 3½-mi. lake section of intake and a 1½-mi. land tunnel leading to the proposed 150-mgd. Nottingham Water Filtration Plant (*ENR*, August 5, 1948, p. 76). Some 20,000 cu.yd. of slag fill was hauled in and spread over the area to keep all pipe casting operations out of the mud during wet weather.

Limited storage area

Although this site limited the "progressive set-up" method of casting and curing to a maximum of 350 pipe in the area at any one time—the total number of pipe required to fulfill the contract is 750 sections, full advantage was taken of the compact area in setting up an integrated and efficient procedure for casting the pipe.

The casting schedule of five pipe per day was predicated on pipe-laying operations being prosecuted fast enough to avoid filling the yard. The first pipe was cast last May 15. By Aug. 15 a total of 260 sections of pipe had been cast and the general contractor was nearly ready to start laying pipe out in Lake Erie. However, rough weather on the lake made it impossible to install any pipe before September, at which time the casting yard was completely filled with finished pipe. Further manufacture of pipe must now be postponed until next spring.

In general, the layout of the pipe-casting plant emphasizes minimum handling of materials and length of haulage. Reinforcing cages are fabricated in a small gantry yard along

Lock Joint Pipe Co. Photo

the south side of the site. A 150-ton, three-compartment, aggregate batching plant is located adjacent to the cage-fabricating area. This leaves the remainder of the area unobstructed for casting and curing the sections of pipe, except for a 50x40-ft., 75-ton gantry crane runway extending completely across the casting area and connecting with a loading dock built out into the lake. With storage area available on both sides of the gantry runway, the heavy pipe sections are rolled a minimum distance to their delivery point at the center of this runway.

Pipe cast vertically

Sand, cement and slag aggregate are purchased from local suppliers and delivered by truck to the batching plant. Reinforcing steel also is trucked to the cage fabricating yard. All concrete pipe are cast in vertical position, on base rings spaced 21-ft. each way and supported on 2x12-in. timbers laid flat on the ground.

Concrete is mixed in a 27-E single-drum paver equipped with a tower attachment and a 20-ft. pouring chute. Dry batches of cement and concrete aggregates are delivered to the paver in two 2-yd. end-dump trucks. The average concrete mix contains 750 lb. of cement, 1,430 lb. of sand and 1,450 lb. of graded slag passing a ¾-in. screen. The 3-ton reinforcing cages are moved from the fabricating yard to the forms on a timber sled pulled by a small tractor.

Fabricating the cages

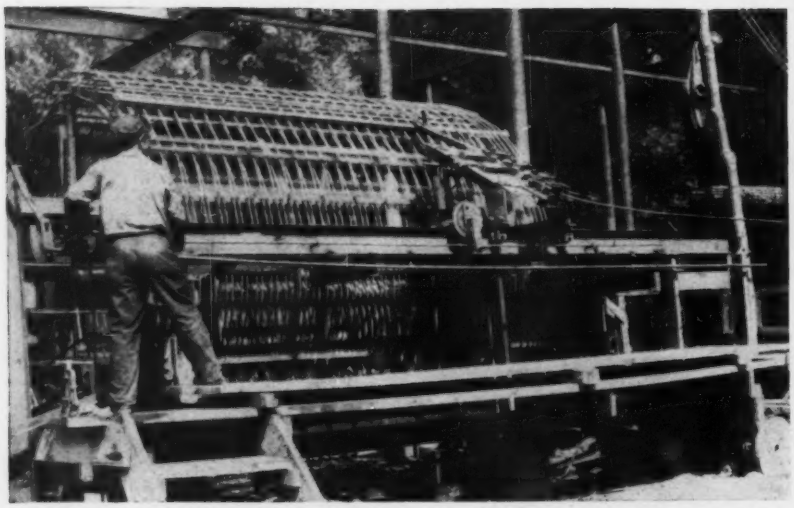
Many of the pipe manufacturing operations are standard procedure found in any large casting yard, but fabricating the reinforcing cages is notable for its simplicity and efficiency. Five complete cages are fabricated each day to keep pace with the concrete pouring schedule. The cages are fabricated under a T-shaped overhead gantry of steel beams supported by steel pipe columns, and equipped with hand-operated chain hoists.

First operation is to form all three bands of reinforcement for a half-cage (12-ft. long) around a steel-frame mandrel rotating in a wrapping machine. The wrapping head moves back and forth at a constant speed, with the spacing of the circumferential reinforcement being controlled by the rotation speed of the mandrel.

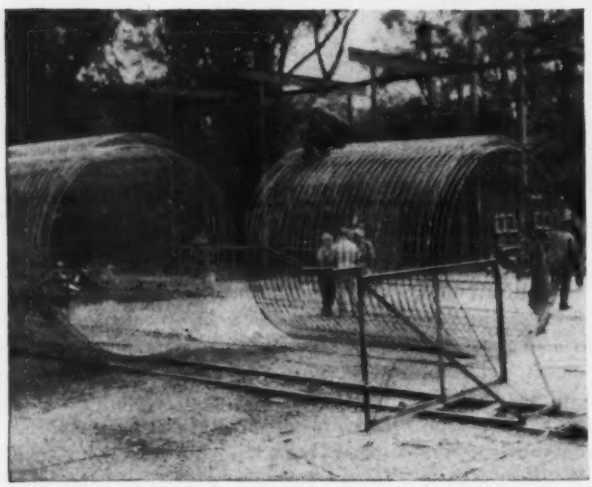
The inner band of circumferential reinforcement is formed first. Special spacer bars made of two ½-in. pipe joined together with steel-strap diaphragms are then inserted in drilled templates welded around the perihpery of both ends of the mandrel, in such a manner as to form the elliptical band of reinforcement. Additional spacer bars then are inserted in holes provided in the templates, for forming the outer band of reinforcement.

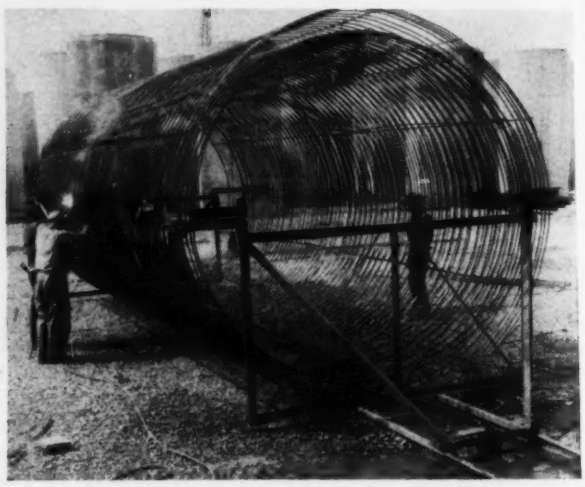
While the cage is still on the mandrel, a few 12-ft. lengths of longitudinal bars are tack-welded in place to hold the three bands in correct position. Mandrel and cage then are removed from the wrapping machine and carried by the overhead trolleys into the stem of the T-shaped gantry frame, where additional 12-ft. lengths of reinforcing bars are tack-welded in place.

The half-cage then is stripped from



FABRICATING THE REINFORCEMENT . . . Three bands of reinforcing steel are spirally wrapped on a single mandrel to form a half-cage 12 ft. long (at left). A few of the required longitudinal bars are tack-welded to the cage to provide needed rigidity, then the cage is stripped from the mandrel (at right).





TWO HALF-CAGES are rolled to assembly track (at left) and full length longitudinal bars are tack-welded in place to complete the cage (at right). Precision-built frame spots pick-up anchor lugs in correct position for welding.

its mandrel and rolled a few feet to the final assembly point where two half-cages are joined together to form a complete 24-ft. cage. Final assembly is on two light-gauge rails spiked to timber ties embedded in the ground to give true alignment to the completed cage. At this point, the remaining longitudinal reinforcement is tack-welded in 24-ft. lengths.

Four 6x¾x30-in. special steel bars are tack-welded to the outer band of reinforcing cages—two at each end of the cage, diametrically opposite each other on the spring line. Steel lugs are welded to these anchor bars after the concrete pipe has been cast. The lugs are located accurately to insure placement of the pipe in the trench so that the elliptical reinforcement will be in true position. By passing a heavy bolt through adjacent lugs, two sections of pipe may be drawn together under water merely by tightening a nut on each bolt.

Five sets of forms

The contractor operates five sets of forms with three base rings for each mold to permit daily use of the forms on a separate base ring. The fourth day the base rings have been removed from the first-day's pipe and may be used again for casting operations. Both the inner and the outer forms are one-piece assemblies, made of ¼-in. steel plate reinforced with circular T-bars. Five external vibrators are attached to the outer form when placing the concrete. No air-entraining agent is added to the cement.

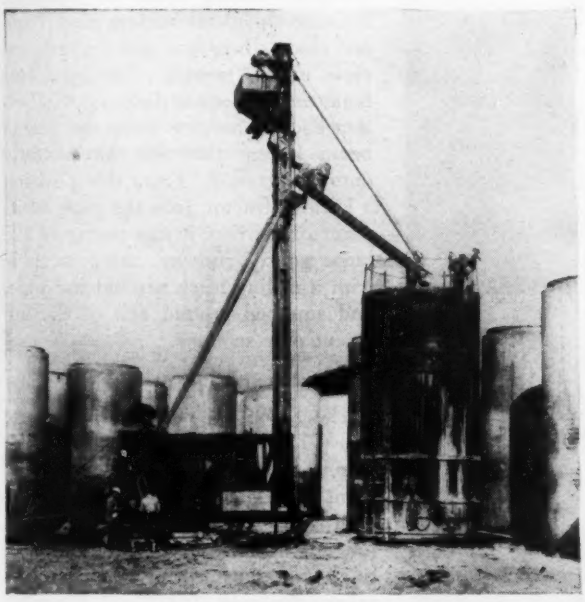
Most of the heavy lifting in the casting yard is done with a 60-ft. boom crawler crane. It mounts a 20-ft. gooseneck extension with a 10-ft. reach to clear the pipes and forms. This crane spots the base ring for each 24-ft. length of concrete pipe, sets the inner and outer steel forms which constitute the mold, installs the reinforcing cage and strips the forms.

The surface of the forms in contact with the concrete are coated with a

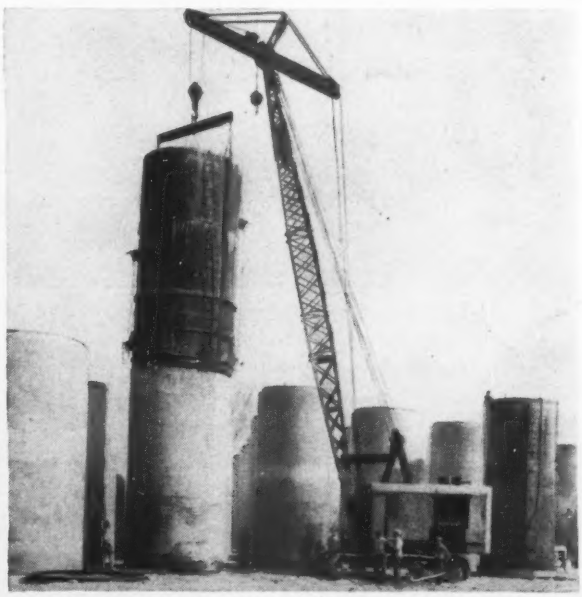
FIVE PIPE A DAY WITH CLOCK-LIKE REGULARITY

REINFORCING CAGE is lowered around inner mold-form, previously coated with a special oil . . .

OUTER FORM, equipped with five external vibrators comes next, so that workmen can . . .



FILL THE MOLD with concrete from a 27-E paver, with tower attachment and pouring chute, and . . .

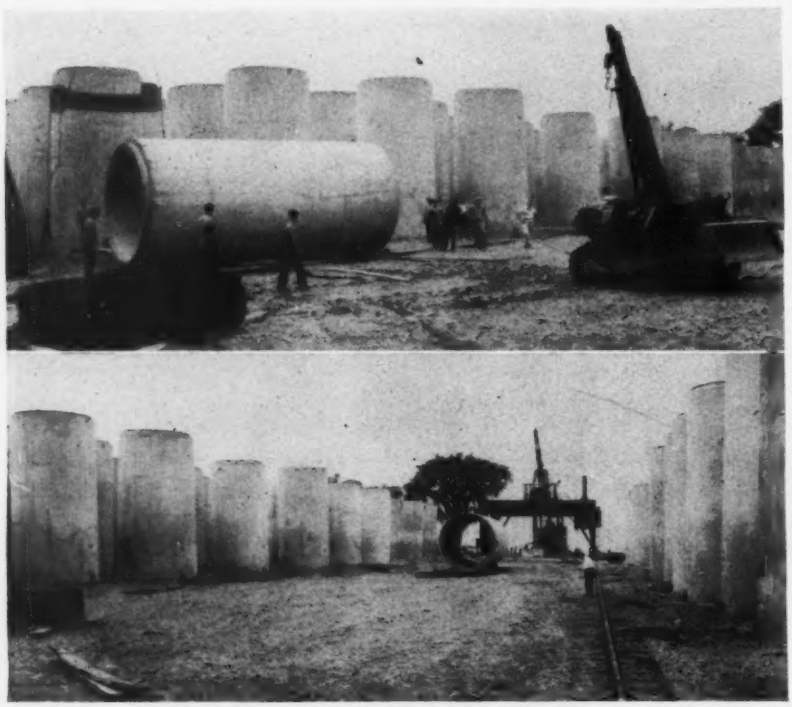


FORMS ARE STRIPPED 24-hr, after pouring concrete, and the completed pipe is coated with a curing compound.

special mixture of oil, using castor machine oil for a base, diluted with fuel oil and containing a special admixture to keep cement dust from adhering to the forms. This protective compound is applied by air gun. A protective membraneous coating for curing the pipe also is sprayed on the pipe immediately after the forms have been stripped.

Special steel joint rings, welded to the reinforcing cage are designed for the use of a rubber gasket joint. The flared bell ring of each pipe fits neatly around the periphery of the spigot ring. Every spigot ring incorporates an annular recess running around its circumference, which accommodates the round rubber gasket. By forcing the spigot ring home into the bell ring, the rubber gasket is tightly compressed to form a watertight seal between adjacent sections of pipe. These rings are cast into the body of the pipe so that the bell ring is covered with concrete only on its exterior; whereas the spigot ring

TIPPING THE PIPE . . . Over and down onto the ground goes a 50-ton pipe section. Load line from crane operates lifting beam on gantry to lift the break up pipe with a steel band-and chain sling, while line from gooseneck tilts 24-ft. reinforced-concrete pipe horizontal.



SMALL TRACTOR uses rolling hitch in its winch line (at top) to roll pipe to center of gantry runway (at bottom) where 75-ton travelling gantry—in far background—delivers it to barge-loading dock built out into Lake Erie.

is covered with concrete only on its interior surface.

Forms are stripped from the pipe 24 hr. after pouring the concrete and, 48 hr. later the pipe is picked up, its base ring knocked off, and the pipe is lowered directly onto the ground where it stands vertically during the 28-day curing period.

A double A-frame gantry, developed for use on previous jobs, is used in picking up the 50-ton pipe sections for removal of the base ring and, later, for tipping the pipe into a horizontal position preparatory to rolling onto the center of the runway of the 75-ton travelling gantry.

Power for operating the A-frame gantry is furnished by the crawler crane, with the load line from the 60-ft. boom operating the lifting beam of the gantry, while a second line from the point-pickup of the gooseneck rotates the pipe 90 deg. as it is lowered into a horizontal position on the ground.

Tipping the pipe

To tip the pipe from a vertical position to the horizontal, the A-frame gantry is placed astraddle of the pipe. A hinged, semi-circular steel band is placed around the pipe at its mid-height. A chain then is run from each end of the lifting beam down around semi-circular castings in the end of the lifting band in such a manner as to complete a sling around the pipe.

As the lifting beam is raised, it tightens the combination steel band and chain sling, thus picking the pipe clear of the ground. The load line from the gooseneck picks up the bottom end of the pipe while the lifting beam lowers the pipe horizontally onto the ground. From this position a crawler tractor rolls the pipe to its point of delivery in the center of the large gantry runway, using a cable with a rolling hitch around the pipe, and snubbed around one of the adjacent pipe sections.

Supervising personnel

The 3½-mi. of 10-ft. dia. concrete pipe (750 sections, 24 ft. long) are being manufactured by the Lock Joint Pipe Co. for the Merritt-Chapman & Scott Corp., general contractors on the lake section of the Nottingham Intake. Glenn B. Parsons is plant manager; William Burgess, plant superintendent and R. T. Durgom, office manager.

Leet Deible is project engineer for Havens & Emerson of Cleveland, Ohio, consultants on the job for the city. A. J. Slaybaugh and George Wilks are assistant project engineers, and Frank Young is chief inspector. V. L. Rock is superintendent for Merritt-Chapman & Scott Corp., and S. H. Serre is vice president in charge of the entire contract.

Planning Fire-Sprinkler Installations

MANY worthwhile results can be attained by planning an automatic sprinkler system for a building during the early design stages. The initial cost of the installation can be lowered, appearance improved and maximum protection achieved.

Architects and consulting engineers are concerned with the installation of these sprinkler systems because most clients for whom business, semi-public and industrial buildings are constructed eventually demand it. Spurring the demand is more than a half century of near-perfect protection, as a result of which the cost of sprinkler protection plus insurance has dropped below that of insurance alone on business and industrial properties.

Other imperative reasons for designing a building with provision for easy and economical installation of sprinklers are: 1. Two out of five burned-out businesses never start again, regardless of insurance coverage of the property loss. 2. Not a single human life has ever been lost by fire in a hotel completely protected by automatic sprinklers; 3. The record over the years has clearly demonstrated that so-called fireproof or fire-resistant construction does not make a building fire-safe, and, 4. Insurance premium savings on sprinklered property over a period of years pay for the system and represent a generous return to the owner on his investment in the system.

Sprinklers effective at early stage

An automatic sprinkler installation is essentially a system of piping just below or concealed in the ceilings, extending within effective distance of every space where fire could start. At specified intervals along this piping, heat-actuated discharge valves or sprinkler heads are installed. These open when heated to permit a local application of water of about the intensity of a heavy rain on the materials that first start burning.

In all fires reported to the National Fire Protection Association from 1897 through 1944, only one sprinkler has had to open to extinguish 35.2 percent of the fires in sprinklered properties. Bear in mind that a fire stream through a 2½-in. hose delivers more water than five open sprinklers—and often too late.

The piping necessary for an automatic sprinkler system will weigh a maximum of 0.5 psf. of ceiling area.

Installations of automatic sprinkler systems are required to comply with the standards of the National Board of Fire Underwriters or the rules of the inspection department of the Associated Factory Mutual Fire Insurance Companies. These include the fundamental recommendation (Standard No. 107 of NBFU Pamphlet No. 13) that sprinkler system layout and installation should be entrusted to none but fully experienced and responsible parties.

An important reason for this official attitude is that an automatic sprinkler system is installed, unlike other equipment, in the hope that it will never be called upon to operate. But if fire does occur in the building —even as much as 25 or 50 years after installation—the system must be ready for instant operation. This is an almost unparalleled requirement, calling for engineering experience and quality of materials of the highest order.

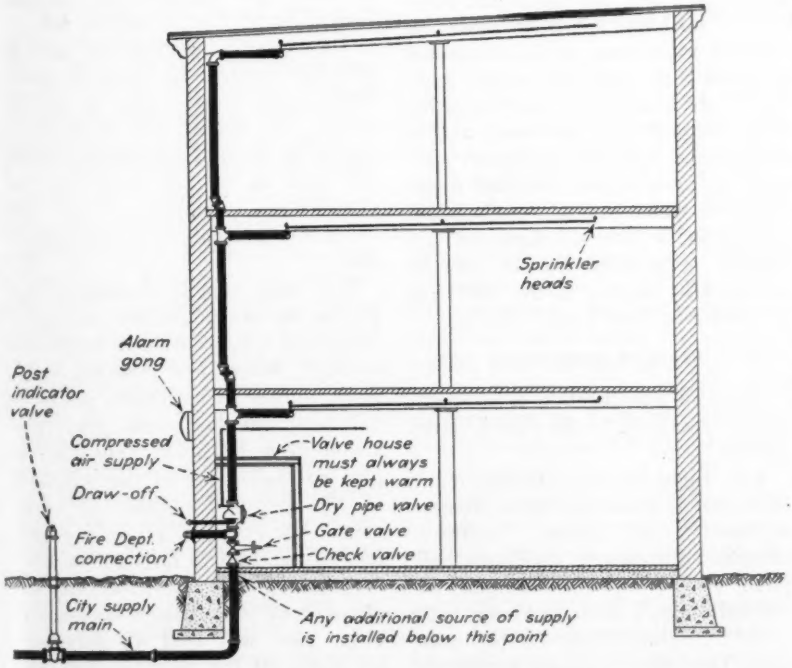


FIG. 1. CROSS SECTION through a building equipped with a dry-pipe system of automatic sprinklers. This type of installation is preferred for buildings subject to freezing temperatures.

Standard systems

Standard automatic sprinkler systems are available in two types—wet-pipe, in which the entire system right up to the sprinkler heads is filled with water at all times, and dry-pipe (Fig. 2) in which the piping within the building is filled with compressed air as far back as a special differential check valve. This valve releases water into the system the instant the air pressure drops because of the opening of the first sprinkler head.

Wet-pipe systems are used in buildings that are always maintained above freezing temperature, whereas the dry-pipe type is used in buildings or sections of buildings that are subject to freezing temperatures. However,

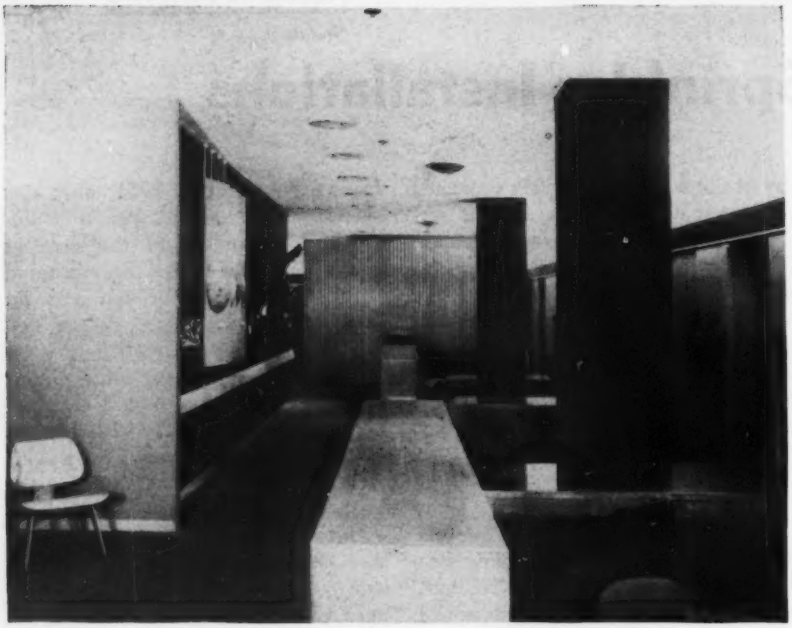


FIG. 2. QUARTZOID SPRINKLERS fed by piping concealed in the ceiling are barely noticeable in this office.

the check valve must be protected against freezing. Sometimes, a wet pipe system filled with a special anti-freeze solution is permitted by the inspection authorities in buildings in which low temperatures can occur.

Special hazard systems

There are also available several types of automatic fire-protection systems for special hazards. Some utilize dispersed water in both high-velocity and low-velocity spray forms for fires in oils, flammable liquids, paints and many other special-hazard materials. Such special systems usually supplement a standard automatic sprinkler system and require similar provisions for access to water supplies. They also benefit from early planning of the building for their installation and call for specialized experience and engineering for their design and installation.

The latest development in special-hazard systems is the Exhaust Water-Spray System for protection of life in buildings with open wells for stairs, moving stairways and elevators (*ENR* July 22, 1948, p. 51). A joint development of Otis Elevator Co., Westinghouse Electric Corp. and Grinnell Company, Inc., this new system prevents open wells from carrying deadly gases and superheated air from a fire starting on one floor to the floors above. Counteracting flue action, forced-draft ventilation is applied to the area where the fire starts and heated gases are cooled by water spray, while the sprinkler system extinguishes or controls the fire.

The major item of expense in automatic sprinkler systems is the labor cost of installing sprinkler heads. At present wage rates, it is economical to select room sizes that permit spacing of the heads at the maximum distance permitted by the standards, in accordance with the occupancy and type of construction. Detailed specifications which should be consulted are given in the standards of the NBFU. (Pamphlet No. 13 may be obtained by writing to the NBFU at 85 John St., New York 7, N. Y.)

Types of occupancies

A partial classification of occupancies as specified by the NBFU is as follows:

(a). Light-Hazard Occupancies: This class includes apartment houses, asylums, club houses, colleges, churches, dormitories, dwellings, hospitals, hotels, libraries, museums, office buildings, schools and tenements.

(b). Ordinary-Hazard Occupancies: This class includes mercantile establishments, warehouses, manufacturing, and occupancies not covered by paragraphs (a) and (c).

(c). Extra-Hazard Occupancies: This class includes only those buildings or portions of buildings where the hazard is severe as determined by the inspection department having jurisdiction.

The protection area allotted per sprinkler varies from 196 sq. ft. for light-hazard occupancy and fire-resistive construction to 70 sq. ft. for extra-hazard occupancy and open joist construction. For economy in planning, it is necessary to consider both the hazard rating of the intended occupancy and the type of construction. For example, a long room of odd dimensions may require an extra line of supply piping. On the other hand, if large area rooms are planned with dimensions that are multiples of 10, 12 or 14 ft. according to the occupancy and construction, appreciable savings can accrue when the automatic-sprinkler contractor is called in. Included in these savings are the cost of additional piping hangers, fittings and sprinkler heads.

Piping concealed when necessary

Where the appearance of exposed piping is objectionable, provision must be made for inclosing the supply lines. An estimate of the dimensions of the required pipeways can be made from a preliminary calculation of number of sprinklers fed.

The largest pipe generally used in sprinkler systems for vertical risers, feed mains, cross mains or branch lines is 6-in. ($6\frac{5}{8}$-in. o.d., about $8\frac{1}{2}$-in. dia. at the band of the fitting), which can feed up to 150 sprinklers for extra-hazard occupancies or 250 heads for ordinary-hazard occupancies.

The same outside dimensions apply for the maximum size of pipe in horizontal runs concealed within the ceiling. Where less than the maximum number of sprinklers are to be fed from one horizontal pipe, provision need be made only for the pipe size called for by the standards for the required number of sprinklers. For example, a 1-in. pipe will feed two sprinklers for light or ordinary-hazard occupancy, but only one sprinkler for extra-hazard occupancy; $2\frac{1}{2}$-in. pipe will feed 40 sprinklers for light, 20 for ordinary but only 15 sprinklers for extra-hazard occupancies.

In offices, hotel lobbies, bedrooms,

cocktail lounges, shops, display rooms and other places where appearance calls for an unobtrusive installation of automatic sprinklers, the new quartzoid ceiling sprinklers, which extend only one inch below the ceiling, may be fed by concealed piping.

Water supplies

To assure a satisfactory supply of water, the following standards should be applied: "Every automatic sprinkler system shall have at least one automatic water supply of adequate pressure, capacity and reliability . . . " "A connection from a reliable waterworks system of adequate capacity and pressure is preferable as a single or a primary supply."

As alternatives under certain conditions, pumps, gravity tanks or pressure tanks may be utilized. A connection through which the public fire department can pump water into the sprinkler system makes a most desirable auxiliary supply. Flow tests from an outside hydrant, delivering 250 gpm. in the case of light-hazard occupancy and 500 gpm. in the case of ordinary-hazard, should provide a residual pressure of not less than 15-lb. pressure at sprinklers located under the roof.

Sprinkler operation temperatures

"Sprinklers shall be of approved makes and types," the standards say. The work of the Underwriters' Laboratories and of the Factory Mutual Laboratories in continuously testing and approving fire-protection devices has been of great help in assuring the success of automatic sprinklers. Every architect and consulting engineer should have a copy of the "List of Inspected Fire-Protection Equipment and materials" of the Underwriters' Laboratories, Inc., and "Approved Equipment for Industrial Fire Protection" of the Associated Factory Mutual Fire Insurance Companies.

Within the approved makes and types of sprinklers, there are variations that are of major importance, because they affect the actuation of the device. Since sprinklers are most effective when they operate as soon as a fire starts, the releases are the key to successful fire-fighting.

The heat-sensitive releases on sprinklers are of two general types—solder and non-solder. In the ordinary temperature ratings, solder-type sprinklers are triggered to release when their temperature reaches 160 to 165 deg. F. The corresponding non-solder types of sprinklers release at temperatures of 135 and 150 deg. F.

In the case of a slow-starting, smoldering fire, the earlier release of a quartzoid sprinkler, a non-solder type, is advantageous. It operates with as much as 30 deg. less ceiling temperature, a distinct gain when measured in minutes and seconds.

For intermediate-degree sprinklers, the solder-type opens at 212 deg. and the non-solder type at 175 deg.; hard-degree sprinklers operate at 286 deg. for solder and 250 deg. for non-solder; and extra-hard degree sprinklers act at 360 deg. for solder and 325 deg. for non-solder. For use in exceptionally high normal-temperature areas, non-solder type sprinklers are obtainable with even higher trigger temperatures, on placement of special order.

Added to their lower trigger temperatures, the non-solder type sprinklers are inherently less subject to corrosion because of the materials used in their manufacture. In locations where they may be brought almost up to their trigger temperatures, in the absence of a fire, there is no weakening of their seals against water flow, such as may occur when solder approaches its melting temperature and has a tendency to creep.

Special type sprinklers

Also available are special-purposes sprinklers such as open, sidewall, corrosion-resistant, window and cornice types. Reference should be made directly to the standards when their use is being considered.

The outstanding effect of automatic sprinkler protection on building design has been to prove conclusively that the inclusion of sprinklers can make both fireproof and non-fireproof buildings fire-safe. Performance records maintained by the National Fire Protection Association show better than 96 percent perfect performance for more than half a century in all types of occupancy and construction. The reason? Shakespeare said it this way: "A little fire is quickly trodden out which being suffered rivers cannot quench."

Eradicating Poison Ivy On Highway Rights-Of-Way

Elimination of poison ivy from New York State Highway rights-of-way has been started by the State Department of Public Works. The fight against this poisonous weed was begun during the past summer when 240 miles of roadside on Long Island and in the vicinity of Syracuse were sprayed with a mixture of chemical herbicides and kerosene.

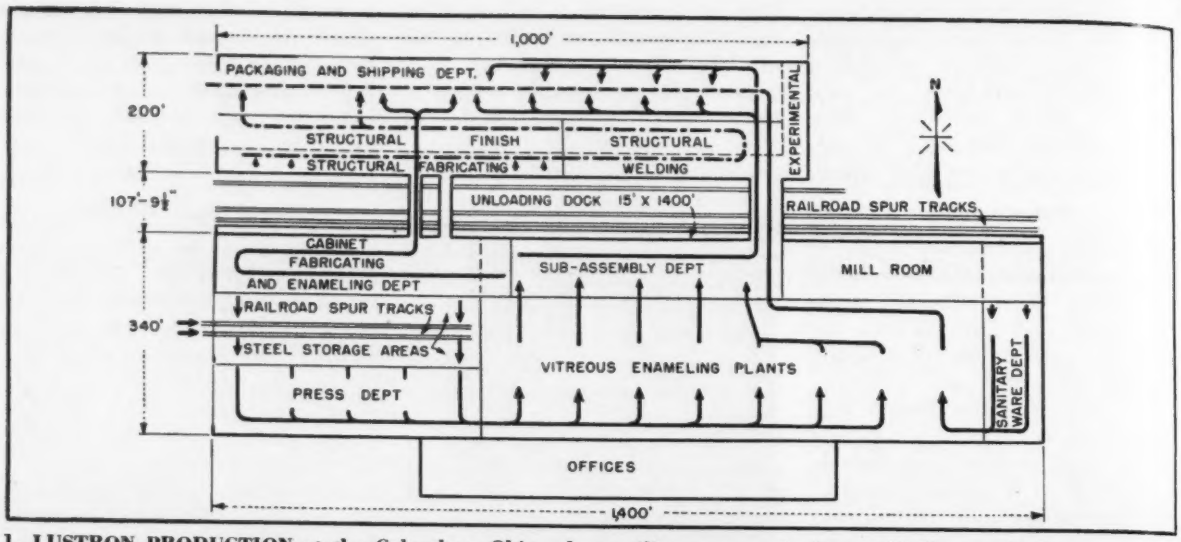
Most spraying this first year has been done with low pressure, in small volumes and by knapsack sprayers, using about six gallons of the mixture per mile treated.

Sprayer equipment and spray guns to hold mist-type nozzle have been specially designed by public-works engineers to meet special needs. Simple, light weight and efficient equipment is not commercially available for application of chemicals by selective methods needed for roadside treatment.

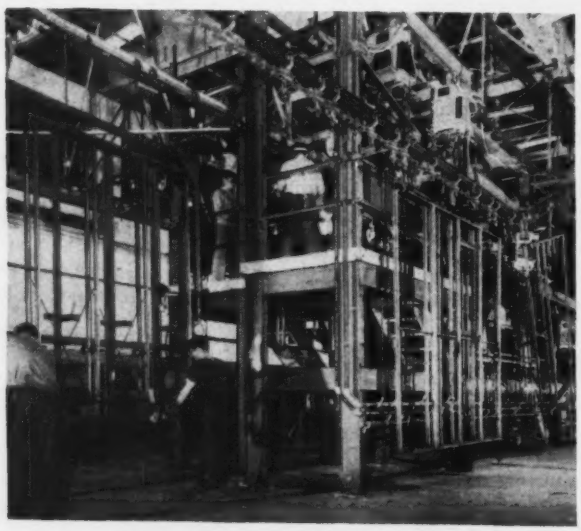
The mixture of the chemical 2,4-D and kerosene has been used because it is non-poisonous, non-corrosive and will not injure soil or most grasses, thereby preserving existing grasses for erosion control and landscaping. Although the total amount of poison ivy has been materially reduced in the areas treated, a small quantity of vines have resisted destruction. Some new growth has occurred which may require one or two additional treatments in limited areas.

The program will be extended to include all roadsides on the state highway system. The best known chemicals and methods will be used and work will be done in seasons when most effective results will be obtained.

Work on the eradication program, which is designed primarily to protect maintenance men from the discomfort and loss of time due to poison-ivy infection, is supervised by Nelson M. Wells, director of the landscape bureau.

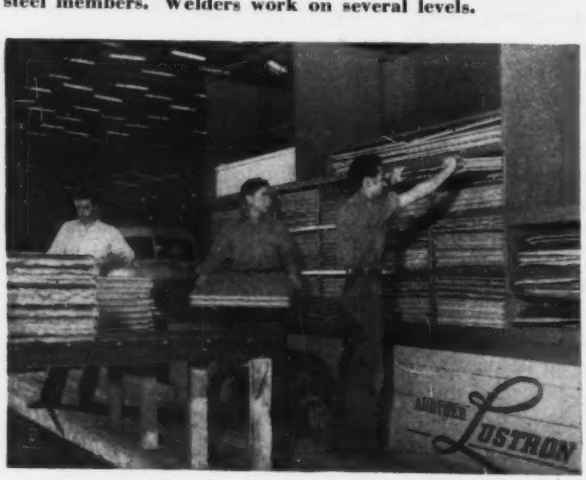


1. LUSTRON PRODUCTION at the Columbus, Ohio, plant utilizes conveyorized assembly-line methods.

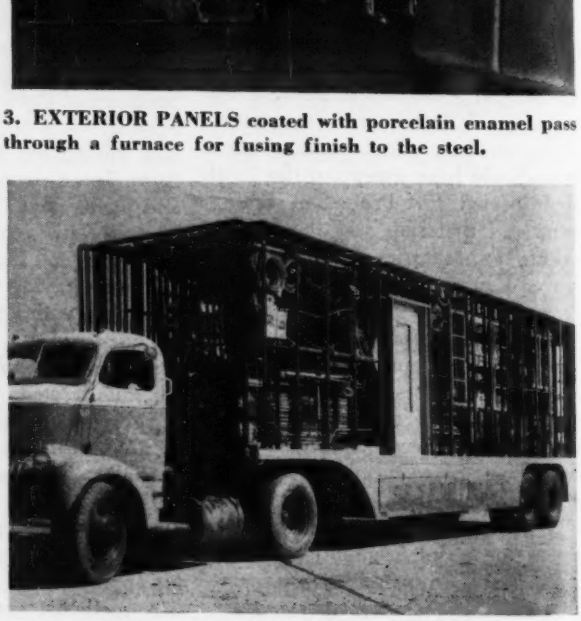


2. WALL SECTIONS are formed by welding light-gage steel members. Welders work on several levels.

3. EXTERIOR PANELS coated with porcelain enamel pass through a furnace for fusing finish to the steel.



4. FOR SHIPMENT, parts for a complete house are packaged in their proper places on a trailer.



5. ARRIVING AT THE SITE, parts are in order for unloading as needed for construction.

Lustron's $14,000,000 Gamble

Factory Production of Porcelain-Enameled Steel Houses Begins, with Steel Procurement a Major Problem

FOR THE PAST EIGHT MONTHS a tooling-up program that is incredible both in magnitude and speed of installation has been underway at the war-built Curtiss-Wright aircraft factory in Columbus, Ohio.

More than $12,500,000 worth of precision machine tools and other equipment have been installed in this huge plant, acquired last November by the Lustron Corporation for the mass-fabrication of 45,000 porcelain-enameled steel houses per year.

Complete packaged units for the pilot models of the Lustron house have already started coming off the conveyor lines and full production at the rate of 150 houses per day is expected to get underway about Dec. 1, 1948.

There is, however, one major contingency in this 150-houses-per-day production rate: It hinges on whether sufficient steel will be forthcoming from the rolling mills to launch the program and to keep it going. Each house contains about ten tons of steel

Lustron officials readily admit that their share of the 59,000 tons of steel to be allocated to the housing industry (*ENR* Aug. 19, p. 73) between now and next Feb. 1, will be in the neighborhood of 45,000 tons. But they are reticent to disclose the amount of steel they have on firm delivery.

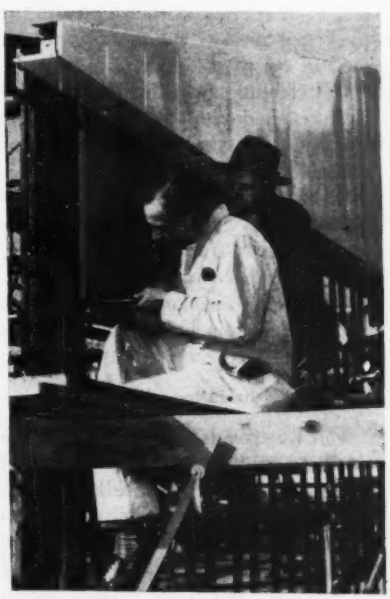
A second unknown factor in this $14,000,000 gamble by Lustron is, of course, whether public demand will create a sustaining market for a house that will cost the owner close to $8,000—complete except for the price of the lot, and landscaping—this price to apply generally within a 500-mi. radius of Columbus, and increasing proportionately for greater lengths of shipment.

Top officials of the corporation, however, are firmly convinced that there will be a tremendous and sustained market for the house. As evidence, they point to the facts that over 800,000 people already have inspected the ten pilot models on display throughout the country and, to date, over 6,700 dealer-builder applications have been received for marketing and erecting the houses.

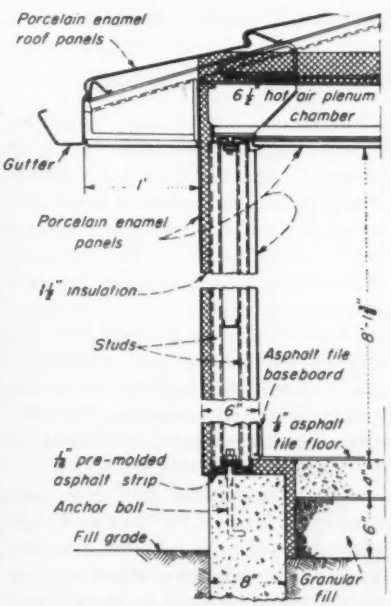
Before describing the Lustron house and its methods of fabrication, a brief resume of some of the more

6. WALL FRAMES, erected first, are bolted to the foundation.

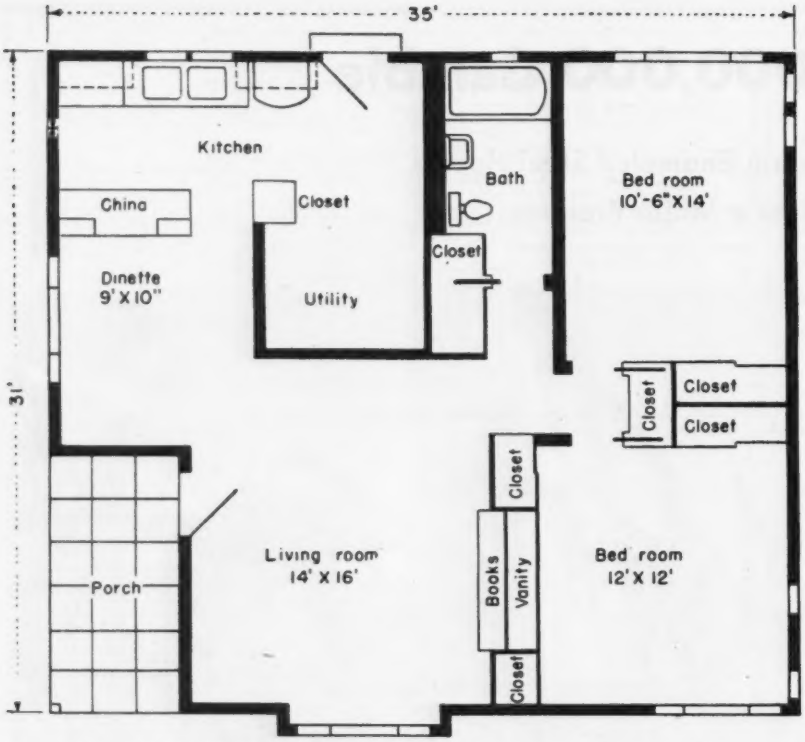
7. ROOF TRUSSES of light-gage steel are fastened to the wall framing.



8. PANELS are bolted to wall frames and trusses and joints calked.



9. THE STRUCTURE is insulated with glass fiber in walls and ceiling.



11. FLOOR PLAN of the two-bedroom house now in production.

important problems involved in setting up this huge assembly line method of prefabrication seems in order.

RFC supplied funds

First came financing. The program could not be started in a small way and expanded from going profits. Only by launching it on a large scale could the fabrication costs be kept sufficiently low to produce a house that would be attractive to the middle-income bracket.

Accordingly, the Lustron Corporation put up $800,000 and secured two loans from the Reconstruction Finance Corporation totaling $25,500,000. To date, about $13,000,000 has been advanced by this agency.

After negotiations had been concluded for lease of the Curtiss-Wright plant from the War Assets Administration, the problem of rapid tooling-up for early production appeared to be an insurmountable obstacle. But initial two-year delivery scheduled for some hard-to-get machine tools and equipment were whittled down to a matter of a few months to meet the urgency of demand.

The transportation problem was solved by packaging the complete house so it can be hauled direct from the fabricating plant to the erection site on a special 32-ft. trailer, or two packaged houses can be shipped on a 65-ft. railroad flatcar.

Satisfactory working agreements were reached with the local unions for employing carpenters, plumbers and electricians—the only crafts needed in the fabricating plant—and little difficulty is anticipated with these unions for on-site erection. Restrictive building codes, however, in certain areas will make it impossible to erect a Lustron house in the areas affected.

Fabrication details

The Lustron house is being fabricated to only one floor plan. It measures 35 x 31 ft. overall, and contains 1,085 sq. ft. of floor area including 60 sq. ft. of porch. There are two bedrooms, 14 x 10½ ft. and 12 x 12 ft; and a 16 x 14-ft. living room; a 10 x 9-ft. dining alcove; a kitchen; a utility room and bath. The house has no basement and, due to the shortage of steel, current operations do not include the prefabrication of a porcelain-enameled garage to go with the house.

When erected on the site, the house is completely equipped with all facilities, except refrigerator and stove. One of the high points in customer appeal is a built-in sink with combination electric dishwasher and clothes-washer. The washer has a capacity of a dinner service for six or of laundering 8 lb. of clothes.

Radiant heating is provided by a forced hot-air system, either gas-fired or oil-fired, placed in the ceiling. There are seven sizable closets, fluorescent lighting fixtures throughout, a kitchen exhaust fan, a 30-gal. automatic water heater, and aluminum windows equipped with screens.

The porcelain-enameled sheet steel panels forming the wall surfaces, ceiling and roof come in a variety of colors, all in non-glossy semi-matte finish. Exterior colors include four pastel shades in tan, yellow, green and turquois, while interiors may be chosen from a combination of eleven colors.

Structural details

Structurally, the house is porcelain-enameled steel, inside and out. Exterior panels are 2 x 2-ft. and backed-up with 1½ in. of glass-fiber insulation. Interior wall panels are for the most part 2 ft. wide by 8 ft. high. The wall framing is made up of vertical steel nailer-joists spaced 2 ft. apart, separated by steel spacers and braced with ⅜-in. diagonal rods welded to the nailers. The roof is porcelain-enameled steel on "bonderized" steel trusses, while the ceiling panels of porcelain-enameled steel are 4 x 4-ft., carrying 4 in. of glass-fiber insulation. Virtually all the steel in the roof trusses and wall framing, as well as the porcelain-enameled roof and wall panels are 20-ga., cold-rolled. The floors are concrete slabs on concrete foundation walls where required, and topped with asphalt tile.

In general, steel plate for the enameled panels, roof trusses and wall framing arrives at the plant cut to size. All fabrication of these units, however, is done in the plant. Trusses and wall framing are welded.

At present, certain items such as the all-metal bathtub, sink, lavoratory and lighting fixtures are purchased from suppliers, but eventually even these will be stamped-out and fabricated in the plant. Then the only materials not fabricated by the corporation will be the aluminum

windows, screens, hot air and hot water heaters, electric conduit and wiring, the combination clothes-washer-dishwasher, the insulation material and the asphalt tile.

In converting the huge aircraft factory, with its 1,100,000 sq. ft. of floor area, into a contemporary plant for the mass fabrication of steel houses by the assembly-line method, one of the largest items of remodeling was constructing the pits and foundations for the larger presses. There are 141 presses, in all, ranging from 25-ton capacity up to 1,800 tons.

Nearly 6 miles of conveyors

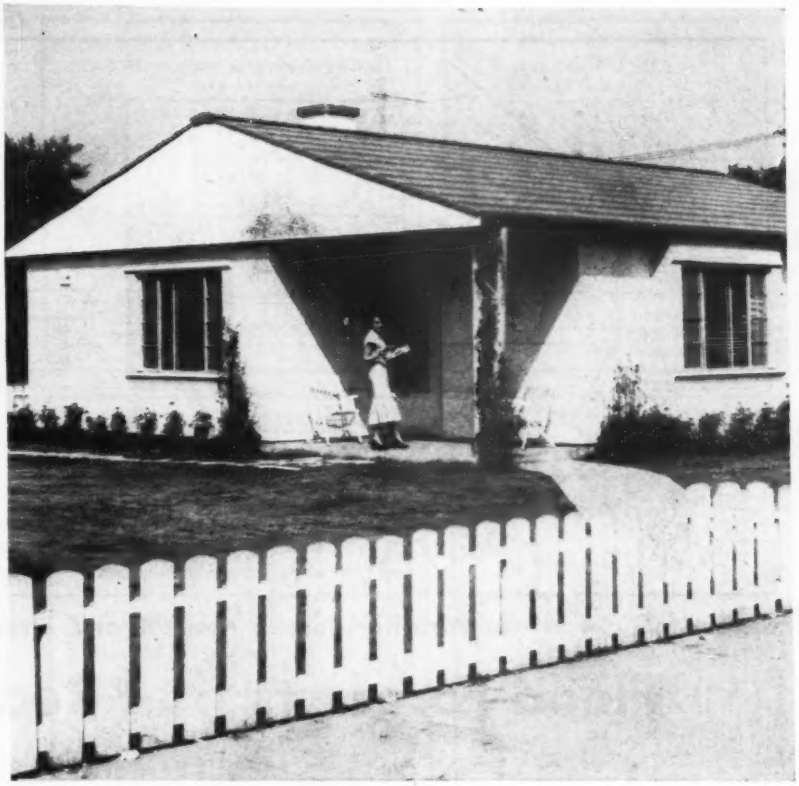
Major items of installed equipment include 21 ball-mills for grinding the clay, color oxides and other ingredients in the porcelain-enamel; 32,000 ft. of endless conveyors, both overhead and shoulder-height; and eleven complete installations for the porcelain-enameling of steel. Each of these units is operated independently of the others.

Each enameling unit includes a pickling unit for cleaning the steel panels; a "bonderizing" unit that applies the protective "ground" coat on both sides of the panel; a dryer; a 4-nozzle automatic spray unit for applying the enamel mix on the exposed side of the steel panel; and a continuous, open-end furnace that produces the porcelain-enamel coating at a temperature of 1,300-deg. F. Nine of the furnaces are gas fired and the other two are electric. The various conveyor lines run from 7 to 20 ft. per min.

Air-conditioning of the huge plant was not deemed practical so each spray unit is protected from dust by a large metal duct that draws off all dust particles and collects them in large metal hoppers.

Two railroad spurs deliver the 20-ga. steel plate just inside the west entrance to the main fabricating plant. Endless conveyors along the sides of the plant deliver the steel to the presses, then on to the enameling areas and to the truss-fabricating area. Trusses are fabricated in two sections, on three-level welding jigs.

Pulverized ingredients constituting the various colored porcelain enamels are charged under vacuum into bins, directly above the ball-mills, from where they flow by gravity to the various spray booths.



12. COMPLETED, the house is expected to sell for about $8,000.

Under full production, all operations of the plant will be geared to the loading of one completely packaged house onto a trailer or railroad car every nine minutes.

Trailers and flatcars will be loaded on assembly lines located in a second building, with finished products being delivered on endless conveyors from the fabricating plant. Designing the "package" was one of the several intricate problems. Finished products are placed in the package in reverse order to their erection sequence in the field. For example, wall sections, the first item in field erection, are added to the package last. In fact, the wall sections are placed on edge along the sides of the trailer or flatcar, and braced top and bottom to provide rigidity in the completed package.

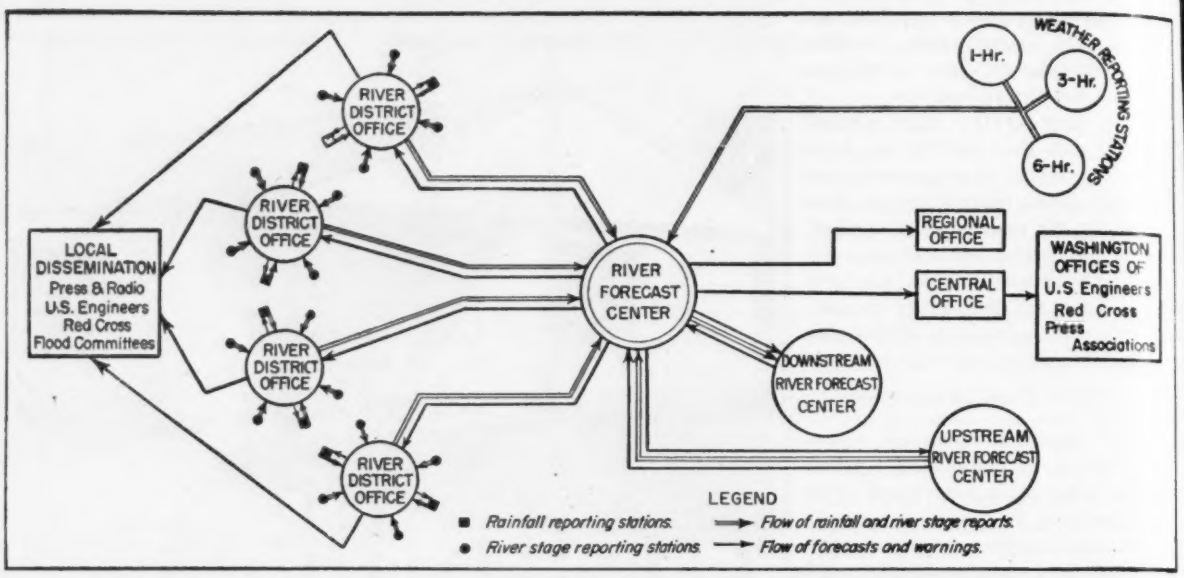
Packaging method expedites erection

This sequence of packaging insures fast and orderly erection in the field, while the fact that each package contains an entire house, complete even to the plumbing and fixtures, eliminates delays often incurred in conventional site-fabricated houses due to late delivery of any of the various construction items.

Top executive staff

Credit for Lustron's remarkable job of tooling-up this large prefabricating plant in such a short time is due in large measure to the executive staff. Sparkplugging the entire program is Carl G. Stranlund, president of the corporation, formerly vice president and general manager of the Chicago Vitreous Enamel Product Co.

Russell G. Davis, formerly with Foote Bros. Gear & Machinery Corp., is executive vice president. Gen. Eugene Reybold, wartime chief of the Corps of Engineers, is vice president in charge of production. Richard N. Jones is vice president in charge of sales; and Lorenzo Semple, for many years with the American Water Works and Electric Co., is vice president in charge of finance. Eugene E. Howe and Robert J. Runyan, both formerly with the Chicago Vitreous Enamel Product Co., are head of the ceramic department and chief engineer, respectively. Earnest Olsen was secured from the Oliver Machinery Co. to be plant superintendent.



Special offices of the Weather Bureau rainfall and stream gaging data for . . .

Flood Forecasts that Reduce Losses

Merrill Bernard

Chief, Climatological and Hydrologic Services,
U. S. Weather Bureau
Washington, D. C.

***Editor's Note**—Forecasting, in its own way, can be as effective in preventing flood loss as the more imposing works ordinarily thought of in connection with flood control. The U. S. Weather Bureau has developed and is continuously perfecting and expanding a flood warning service that furnishes timely advance notice of flood stages to be guarded against downstream. A series of three articles, of which this is the first, describe the overall functions of the existing service; the operation of a river forecasting center; and the invention and operation of an electronic machine for producing flood hydrographs by electrical analogy.*

FLOOD CONTROL, reduced to its simplest terms, is the elimination or reduction of damage by floods to human life and health, physical property, and the social and economic life of communities affected. It is a reasonable assertion that any means which will accomplish flood control as so defined should be considered as an integral part of the nation's flood control program.

If an object occupies a position in a flood plain, which has been reached by a past flood, damage to that object can be prevented in future floods by:

(1) Withholding or diverting the runoff from future storms by means of reservoirs or other flood control works to such an extent that the stream will not rise to the elevation occupied by the object;

(2) Preparation of temporary works, such as sand bag barricades, which will prevent the flood waters from reaching and damaging the object;

(3) The removal of the object to a safe location in advance of the arrival of the flood waters.

It is obvious that the success of the second and third means of flood control, as here defined, depends on the ability to forecast the flood sufficiently far in advance to permit the necessary emergency preparation.

It is likewise apparent that the successful operation of flood-control works defined in the first category of flood control measures must depend upon the flood forecast. On small basins, because of the critically short concentration periods usually involved, the operation also becomes heavily dependent upon a forecast of flood-producing rainfall. Where the control works are intended to serve multiple purposes, including power generation and irrigation, the dependence on forecasts measurably increases.

Since it is generally conceded that there are many localities subject to flood damage where physical conditions and costs, or both, make the installation of flood control works infeasible, the need for flood forecasting in such circumstances is readily obvious.

Timeliness essential

To serve its purpose, a flood forecast must be timely, complete and relatively accurate. The first essen-

tial is timeliness; completeness and accuracy add little to the value of a forecast that comes too late to be acted upon. General warnings, if issued far enough in advance to permit adequate protective measures, are far more valuable than precise but belated forecasts.

A flood forecast, to be complete, must include not only the expected crest stage, but the rising and falling stages—in other words, the forecast should be that of the flood hydrograph. Accuracy is the result of successful timing as the flood progresses to its peak and recedes.

Forecasts are most useful during the early development of an incipient flood, even though they must be expressed in a rather wide range of stage. This range narrows as observed rainfall replaces the forecast amounts until, at the end of the rain period, a forecast can be issued on the basis of wholly determinable factors.

Types of forecast

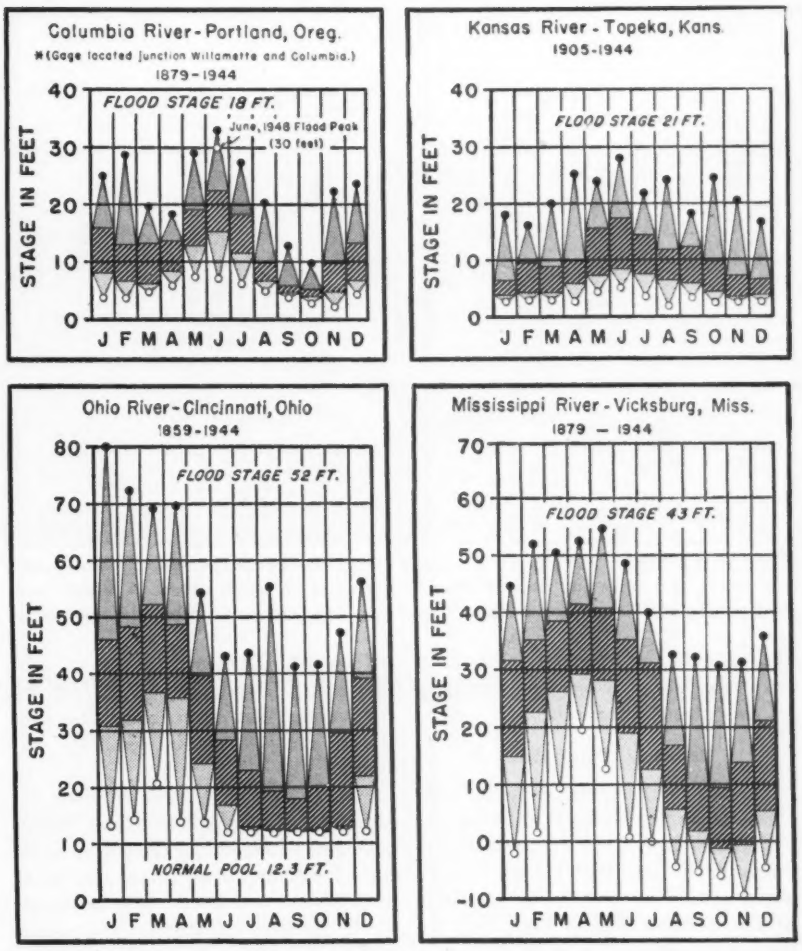
Types of forecasts utilized by the Weather Bureau can be classified according to the conditions that determine the methods used in making them.

Main stream forecasts: Applied to the larger rivers and to the lower reaches of the principal tributaries where slope, channel storage capacity and length of reach assure dependable and consistent relationships between factors involved in flood routing procedures.

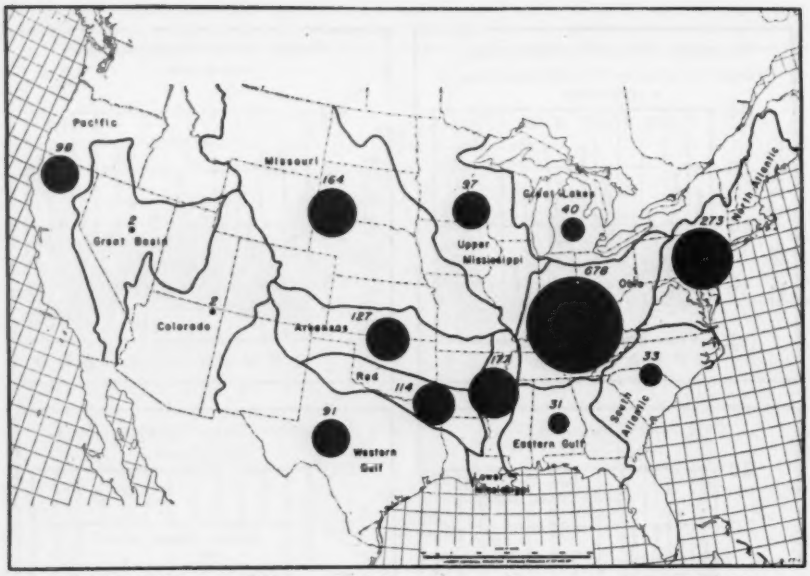
Tributary forecasts: Utilized where channel slope, stream system pattern, and basin area establish a concentration period within which it is practicable to: (1) arrange for orderly collection and transmission of rainfall and stream-flow data; (2) formulate forecasts of flood stage; (3) disseminate the forecasts to all points affected; and (4), of greatest importance, allow enough time for the community to remove damageable goods and property and to take protective measures. Rainfall-runoff relations are the basis for these forecasts, with unit hydrographs and flow routing techniques furnishing the means for assembling and routing the resulting flood flows.

Headwater warnings: Applied beyond the range of conditions under which successful tributary forecasting is possible. Within this "headwater warning" zone, flood waters rise practically as the rain falls. Under these conditions the warnings must be based upon observations of rapidly accumulating rainfall made at frequent intervals throughout the period of the storm. To be effective, the rainfall reports must be transmitted directly from the observer to a Weather Bureau representative in the threatened community. He, in turn, must disseminate the information promptly under a well-organized local plan of action. Estimates of the amount of rain required to cause floodings are transmitted to the bureau's representative in advance of anticipated storms in order that he may convert the rainfall, as it is reported, into terms of local flood heights.

Obviously, to observe, record, transmit, receive, tabulate, and analyze the several elements that enter into the forecasts demands a closely organized service characterized by constant alertness, dependability of communications, and simplicity of method, in addition to experienced judgment of trained personnel. Also because a river community customarily dismisses all thoughts of a flood within a short time after its passing, and thus reacts belatedly to forecasts and warnings issued in advance of the next flood, the national flood forecasting service should be equipped to take the initiative in maintaining alertness on the part of


Columbia River - Portland, Oreg.
*(Gage located Junction Willamette and Columbia.)
1879-1944
FLOOD STAGE 18 FT.
June, 1948 Flood Peak (30 feet)
STAGE IN FEET
J F M A M J J A S O N D
Kansas River - Topeka, Kans.
1905-1944
FLOOD STAGE 21 FT.
Ohio River - Cincinnati, Ohio
1859-1944
FLOOD STAGE 52 FT.
NORMAL POOL 12.3 FT.
Mississippi River - Vicksburg, Miss.
1879 — 1944
FLOOD STAGE 43 FT.

FLOOD RECORDS BY MONTHS for selected river stations indicate high water expectancies throughout the year. During 25 percent of the years of record the maximum monthly stage fell in the upper shaded area during 50 per cent of the years in the middle cross-hatched area, and during 25 per cent in the lower shaded area. The Weather Bureau has flood statistics of this kind for about 1,200 river stations.



FLOOD LOSSES in millions of dollars for a 20-year period, 1924-43, are shown on this map for each of the 14 major river basin areas. A flood forecast center is planned for each of the areas, and four are already in operation.

the public. Unfortunately, this is a responsibility beyond the capacity of its present organization.

Reducing flood losses

One of the accompanying illustrations shows the seasonal distribution of floods for four representative communities in the United States while another depicts the distribution of the average annual flood loss of the entire nation, which is estimated at $225,000,000. It is believed this loss would be at least $25,000,000 greater if the present flood forecasting service were not in operation. With a really adequate flood forecasting service it is estimated that the potential annual flood damage could be reduced by about $67,000,000.

The present service costs about $900,000 a year, giving a cost-to-benefit ratio of 1 to 31. Complete national service would cost about $2,000,000 annually, slightly improving the ratio of cost to benefit. Loss of life, now averaging about 100 per year, could also be materially reduced.

Successful flood forecasting depends heavily on the observation and the forecasting of the weather. Congress, in a law dated Oct. 1. 1890, said that the Weather Bureau shall have charge of forecasting the weather; the issue of storm warnings; and the gaging and reporting of rivers. The bureau made a substantial beginning in 1892 by establishing 166 river observing stations and 59 special rainfall stations.

Our national weather services today are considered the most extensive and successful in the world. With new facilities for sampling the upper atmosphere and portraying the large-scale features of atmospheric circulation, the meteorologist is gradually extending the range and accuracy of his weather forecasts. Weather Bureau facilities now at his disposal include:

(a) A dense station network covering the North American continent; these stations take observations both at the surface and in the upper air.

(b) A system of twelve weather forecasting centers in the continental United States.

(c) A communications system of 80,000 miles of teletype circuit for assembling synoptic (current) data at forecast centers at 1-hr., 3-hr. and 6-hr. intervals.

(d) An international communications service to transmit synoptic weather data and analyses from all parts of the Northern Hemisphere.

(e) Technically-trained staffs utilizing the latest forecasting techniques.

(f) An active program of meteorological research in collaboration with leading universities, the armed forces, and other public and private agencies.

(g) Radio time allocated for broadcasting weather information; the value of this broadcasting time has been capitalized at $10,000,000 a year.

Thus the national weather organization offers a substantial foundation for a flood forecasting service by giving warning of the approach of flood-producing storms and in determining their position, extent and severity.

Hydrology of flood forecasts

As quickly as rain begins, observed rainfall takes the place of anticipated rainfall in the forecasting computations. Hydrologic procedures convert rainfall into runoff, and then into flood stage at selected points along the rivers. Established Weather Bureau facilities for carrying the flood forecast through the hydrologic phase are:

(a) A reporting network of more than 2,500 precipitation and river stage stations (many of them operated in cooperation with the Corps of Engineers);

(b) A new system of river forecasting centers staffed with trained hydrologists; centers for the Ohio and Lower Missouri were authorized in 1947, and for the Middle Mississippi and Arkansas in 1948.

(c) A system of 80 river district offices that serve as report-collection centers and as outlets for flood forecasts and warnings.

(d) Modern forecasting techniques such as the use of an electronic flood routing machine which will be described in the third article of this series. An active development program constantly improves the procedures.

Establishment of the forecasting centers, noted in (b) above, represents the latest and most important forward step in the development of an adequate flood forecasting service. Located at Cincinnati, Kansas City, Tulsa and St. Louis, their efficacy was demonstrated during the spring floods this year, when the Cincinnati and Kansas City offices were able to forecast Ohio River and lower Missouri River stages accurately, well ahead of the rising water. The next article in this series will describe the operation of the Cincinnati center.

FIG. 1. MIXED-IN-PLACE SURFACING in North Carolina is done by contract, releasing state forces for other work.

Contracting Cuts Road Maintenance Costs

A. N. Carter

Manager, Highway Contractors' Division
Associated General Contractors of America
Washington, D. C.

MANY state highway departments and a few city public-works departments have appreciably reduced the total cost of their highway or street maintenance by doing part of the work by contract. More work can be handled in this way in a year, and the regular maintenance forces can concentrate on work that does not lend itself to contract methods. Also, the contract method makes available to highway departments construction equipment and skilled manpower that could not otherwise be obtained to meet their growing maintenance requirements.

Large 1948 program

Maintenance expenditures of the state highway departments in 1948 are estimated by the Public Roads Adminstration at $400,000,000, or about one-third of what will be spent for new construction. In a survey of the amount of maintenance done by contract made by the PRA earlier this year, 30 states reported that they did part of their 1947 maintenance by contract. Of these, over one-third did more than 15 percent in this way and one-fourth over 20 percent.

South Carolina did 34 percent by contract, North Dakota 30 percent. New Hampshire 26 percent and North Carolina 20 percent, according to PRA data. Most states expect to do more maintenance by contract this year. The scope of this work is indicated by the fact that North Carolina did $8,000,000 of maintenance by contract in 1947.

Varied work in North Carolina

In North Carolina, maintenance by contract methods has included five major types of work: (1) low-type bituminous resurfacing; (2) high-type bituminous resurfacing; (3) crushing and stockpiling aggregate for use by state maintenance forces; (4) crushing and placing aggregate on the road surface; and (5) hauling crushed aggregate from the railroad siding to desired point on the road. This year, projects for cleaning and painting bridges are also being advertised.

North Carolina projects are grouped so that they will be attractive to the contractors. As a rule, that state has experienced no difficulties in getting bidders, according to B. W. Davis, state maintenance engineer. A number of contractors in North Carolina are prepared to bid on low-type bituminous resurfacing, and several other firms are equipped with portable and semi-portable crushing and screening plants. Contract maintenance work is given the same type of supervision as contract construction.

The low-type resurfacing consists of approximately 35 lb. of crushed aggregate and 0.42 gal. of RC-2 asphalt per sq. yd. Unit prices for this work range from $0.145 to $0.160 per sq. yd., which compares very closely with the cost of similar work performed by forces in the employ of the state.

High-type resurfacing in that state consists of both plant-mix sand-asphalt and plant-mix asphaltic concrete. Contract price for the sand-asphalt ranges from $4.50 to $6.00 per ton in place on the road, and that for asphaltic concrete from $6.00 to $8.00 per ton.

Other prices for contract maintenance are listed by Mr. Davis as follows: Crushed stone for traffic-bound macadam type work (1½-in. diameter and smaller) from $1.40 to $1.75 per ton stockpiled at the crusher, crushed gravel for similar work from $1.00 to $1.35 per ton stockpiled at

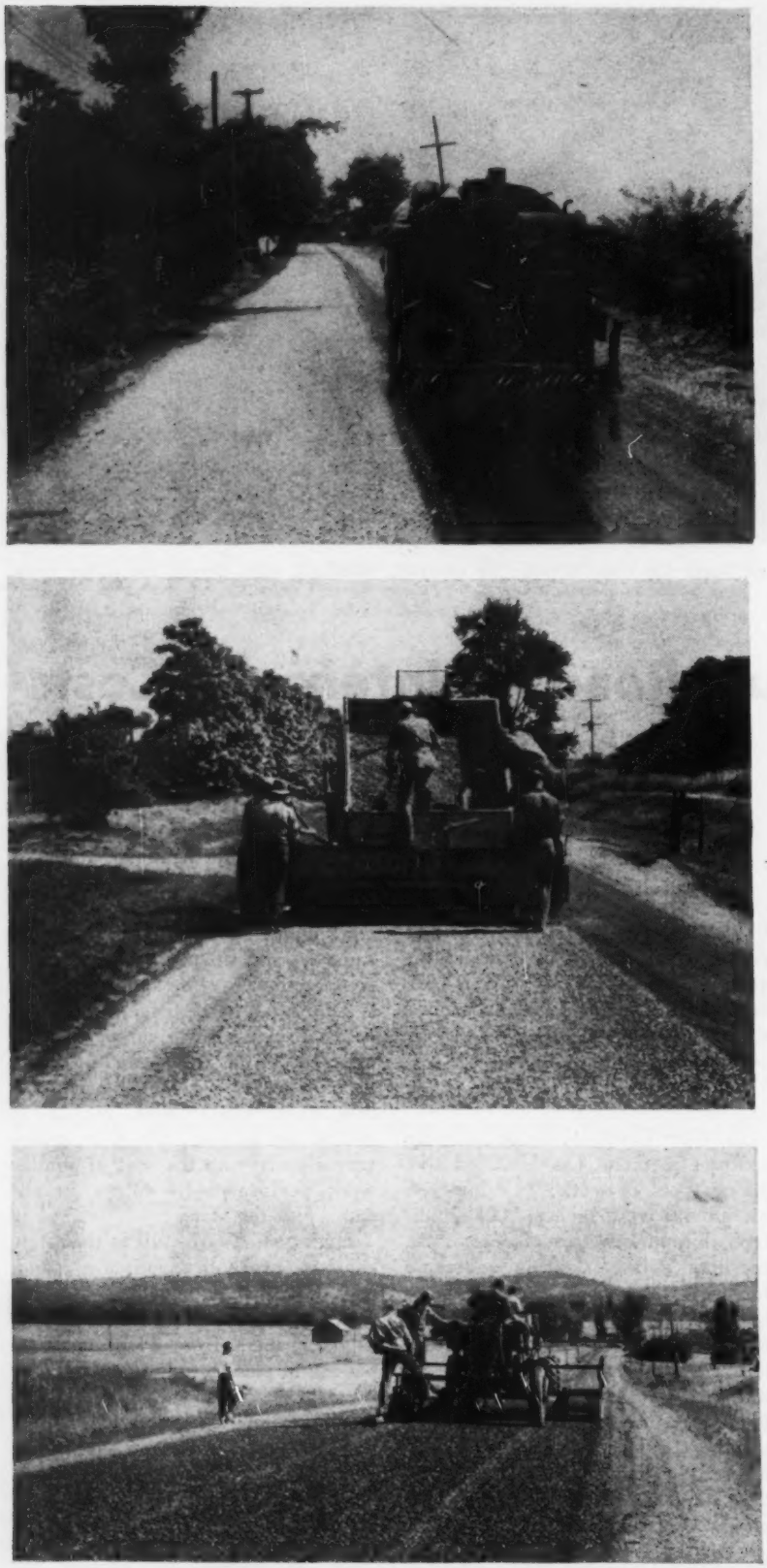


FIG. 2. THREE STAGES OF RESURFACING by contract in Ohio. A seal coat of asphalt (top photo) was first applied to the old surface, stone was then added from a spreader box and blade mixed to complete the job.

the crusher, and hauling from the stockpile to the road from $0.05 to $0.07 per ton-mile.

Much work done in Ohio

Bituminous surface treatment, bridge painting, guard rail painting and guard rail construction and reconstruction are the four principal types of maintenance done on a large scale by contract methods by the Ohio Department of Highways, Earl L. Reeb, director of the department, reports. With the exception of isolated sections of short mileage, on which it would be difficult to get reasonable bids, all surface treatment is done by this method, including seal treatments and drag or mixed-in-place treatments of various thicknesses.

Prospective bidders are given a proposal sheet for each proposal making up the contract, the latter sheet including a summary of quantities and general notes. A contract may cover from one to ten proposals and the proposals of a given contract cover specific sections of highway within the same general area. Some 105 contracts of this type, totaling about $4,500,000, were awarded this year.

Contract bridge painting is now becoming the established policy of the Ohio department. Bidders receive a line drawing of each bridge, a summary of quantities and general notes. Each structure to be painted is listed as a proposal of a contract, and each contract covers the structures in a limited area to avoid long moves of contractor's men and equipment. The work covers cleaning by sand blasting, spot painting or a full prime coat, and one full coat of aluminum paint.

Bridge painting contracts awarded by Ohio in 1948 will cover 31 jobs on 266 bridges with a total estimated cost of $165,000. In general, the contractors will be paid on partial estimates covering a completed proposal if the structures are small.

Ohio guard rails suffered from a lack of maintenance during the war years, due to a scarcity of materials and manpower, and the state is using the contract method to bring the rail up to standard. Construction consists principally of replacing obsolete or deteriorated rail.

Contracts for painting and con-

struction also are confined to a specific route whenever possible. This year guard rail construction in Ohio will total 120,000 lin. ft. at an estimated cost of $234,000 and painting of existing rail 800,000 lin. ft. at $84,000.

South Carolina work awarded

Over 70 percent of the large 1947 bituminous retread program of the South Carolina State Highway Department was carried out by contract. The procedure followed satisfactorily was outlined in *Engineering News-Record* July 8, p. 128.

This year, South Carolina awarded the major portion of its resurfacing work of both low-type and high-type bituminous pavements, according to W. K. Beckham, maintenance engineer of the department. Contract prices for treatment work known as Class "A" according to the designation used by the PRA vary between $0.12 and $0.15 per sq. yd. This treatment requires about 32 lb. of aggregate of No. 5 classification and 0.38 to 0.43 gal. of hot asphalt per square yard. For addition of 80 lb. per sq. yd. of hot-mix asphaltic concrete the price varies from $0.25 to $0.29, the variation in cost being due primarily to the difference in haul distances and transportation costs.

Resurfacing contractors in South Carolina furnish all materials, with the contractor using his own forces from beginning to end of the job, work being handled the same way as new construction contracts, including the engineering and inspection supervision.

South Carolina has found more than enough contractors interested in the resurfacing operations. These firms include about a dozen organizations that are already specializing in resurfacing work.

Variety of other work

A large variety of contract maintenance is being carried out by other states.

Louisiana—which let contracts for one-fifth of a $13,000,000 maintenance program in 1947—used this method for sealing joints and cracks in portland-cement concrete pavement by use of liquid asphalt. Pneumatic equipment was used to drill the holes in the pavement to inject the asphalt, and the contractor was paid

FIG. 3. MUCH STREET PATCHING in Washington D. C., is done by contract, where 90 percent of the maintenance now is carried out in that way.

FIG. 4. FLAME CLEANING AND PAINTING of steel bridges by contract facilitates the organization of efficient paint gangs.

FIG. 5. SPRAY PAINTING OF GUARD RAILS replaces brushes and paint pots for maintenance work in Ohio.

FIG. 6. RESURFACING BY CONTRACT, if done regularly, permits contractors to specialize in that type of maintenance work and acquire special equipment.

FIG. 7. TEARING UP AND REPLACING entire sections of pavement, where that becomes necessary, is done by contract in Washington, D. C.

a specified amount per hole drilled and per gallon of asphalt used for undersealing. Results were so satisfactory that this year this state has contracted for a large additional mileage. It will also do a good share of its surface treatment by contract.

Alabama, Florida, Idaho, Louisiana, Maryland, Massachusetts, Montana, New Jersey, New York, North Dakota, Kentucky and Oregon contract for the repainting of major bridges.

New Jersey is now awarding some snow-removal work. Delaware, New Mexico and North Carolina all report a large increase in surface treatment awards was planned for this year.

Patching of both rigid and nonrigid pavements, installation of added drainage facilities, including catchbasins, manholes and pipe, for existing highways, and spreading of abrasives on highways in the winter are added types of maintenance now being done by some states by contract. Although a few years ago maintenance crews might have been used for widening work, most states are now doing it by contract.

Many U. S. cities and counties are increasing their maintenance work done by contract methods. Over 90 percent of the yearly cost of maintaining nearly 1,000 miles of roads and streets in Washington, D. C. is handled by the contract method. Engineers of the District of Columbia point out they award anything that can be done logically on a unit-price basis.

This produces two major types of contracts. One pertains to resurfacing of improved streets with bituminous materials. Each such contract calls for resurfacing of specified streets with the contractor paid on a unit-price basis.

The second pertains to patching of pavements damaged under traffic and those areas torn up in the installation of utility lines, sewers and similar facilities. This work has been done by contract since 1930. In awarding this work a procedure is followed that is considered unusual. Late in December a letting is held for all of the patching work that is expected to be required in the first six months of the next year, and then in June a similar letting is held for patching anticipated for the last half of the year.

The scope of these operations is revealed by the fact that $264,000 of this type of construction was done during the first five months of 1948 and that when bids were opened in June for patching in the eastern section of the city during the last half of 1948, the low bid was nearly $260,000.

Volume of work indicated

In bidding on the patching, the contractor bids on given amounts of four or five basic types of work on a unit-price basis, with the understanding that at least 75 percent and not more than 125 percent of the volume of work listed will be done. These basic items usually consist of patching portland-cement concrete pavements, asphaltic-concrete surfacing, brick sidewalks, concrete sidewalks, and sheet-asphalt surfacing. In addition, the contractor submits unit-price bids for secondary types of work, such as setting granite curbs and adjusting manhole covers, With the understanding that the quantities of this construction may vary greatly from that indicated. All materials are supplied by the contractor, except brick, which is produced by prison labor.

The great value of doing resurfacing work by contract methods was

illustrated forcibly at Miami, Fla., during the fall of 1947. Due to heavy rains, many streets, which consist of a base of limerock with a bituminous surface, were under water and suffered considerable damage. When the floods receded it became apparent that large-scale repairs were needed at once to prevent still greater destruction.

City engineer forces made surveys of the damaged streets, prepared specifications, and awarded contracts to ten local contractors at a cost of $618,000 in a period of ten days. In all, 245 miles of work was awarded in this brief period, of which about one-fifth was repaving and most of the remainder patching and then resurfacing.

In the repaving operations the old pavement was scarified to a depth of 5 in., from 2 to 3 in. of new limerock added, the base recompacted and a bituminous surface treatment applied. General procedure on resurfacing was to patch the old pavement with cold-mix asphaltic concrete and then add sand-asphalt surfacing, or to apply a hot-mix asphaltic concrete surfacing with a paver.

Patching in St. Louis County

St. Louis County, Missouri, this year started a new practice when it awarded to contract much of the work of patching 87 miles of road previously improved with a bituminous-macadam surface. The grading of shoulders and side ditches for much of this mileage is also being done by contract. The procedure followed is so satisfactory that the Missouri State Highway Commission has approved use of state funds on the work in accordance with a 1946 law authorizing state participation on county road jobs up to 50 percent of the total cost but not to exceed $750 per mile.

The county's patching specifications provide for the use of a cold-mix asphaltic concrete. This material is supplied by the county, being purchased from a commercial producer at $7.45 per ton. The paving contractor is paid on a basis of per ton of cold-mix put down and the work is limited to 15 tons per mile with the areas to be patched designated by the inspectors on the job as the operation advances. For this work the contractor's bid price has varied from $8 to $15 per ton. Results have proven highly satisfactory, A. J. Pfeiler, county highway engineer, reports.

Grading shoulders and cutting side ditches by contract methods has also proven satisfactory in St. Louis County. Motorized graders are employed in this work and operations are carried out as the inspectors designate, the engineering staff going over the jobs well ahead of time with the inspectors, to determine areas to be graded. For the combination operation of cutting the side ditches and shaping up the shoulder the contractor is generally paid 9 cents per lineal foot for one side of the highway, or 18 cents for both sides.

AMOUNT OF HIGHWAY MAINTENANCE DONE BY CONTRACT

(From reports of state highway departments to ENR in January, 1948)

	Expenditures for Maintenance by Contract	
States	1947	1948
Alabama	$459,000	$500,000
Arizona	.....	.....
Arkansas	.....	.....
California	403,000	.....
Colorado	.....	.....
Connecticut	.....	.....
Delaware	350,000	350,000
District of Columbia	411,000	450,000
Florida	1,982,000	2,250,000
Georgia	1,094,000	2,500,000
Idaho	543,000	700,000
Illinois	160,000	200,000
Indiana	346,000	350,000
Iowa	1,010,000	1,100,000
Kansas	1,550,000	1,500,000
Kentucky	.....	.....
Louisiana	2,305,000	1,200,000
Maine	108,000	.....
Maryland	.....	.....
Massachusetts	230,000	475,000
Michigan	8,211,000	8,918,000
Minnesota	2,600,000	2,750,000
Mississippi	.....	.....
Missouri	.....	.....
Montana	325,000	300,000
Nebraska	900,000	1,000,000
Nevada	.....	.....
New Hampshire	.....	.....
New Jersey	.....	.....
New Mexico	294,000	.....
New York	86,000	.....
North Carolina	.....	.....
North Dakota	590,000	500,000
Ohio	4,000,000	5,500,000
Oklahoma	1,009,000	2,200,000
Oregon	400,000	400,000
Pennsylvania	.....	.....
Rhode Island	.....	.....
South Carolina	2,179,000	2,000,000
South Dakota	650,000	1,100,000
Tennessee	1,500,000	1,750,000
Texas	.....	.....
Utah	341,000	350,000
Vermont	.....	.....
Virginia	3,016,000	2,400,000
Washington	.....	.....
West Virginia	2,004,000	2,000,000
Wisconsin	540,000	1,000,000
Wyoming	.....	.....

Major advantages are cited

Numerous advantages other than a major cost saving are listed by those states and local organizations awarding maintenance operations. These include:

(1) During a period when some types of equipment are difficult to secure, work can be carried out without delay and without making large investments in machinery for which there may be only part time use.

(2) Regular maintenance forces are released for other work and the necessity of hiring additional men on a temporary basis during the summer months when labor is hard to secure is avoided.

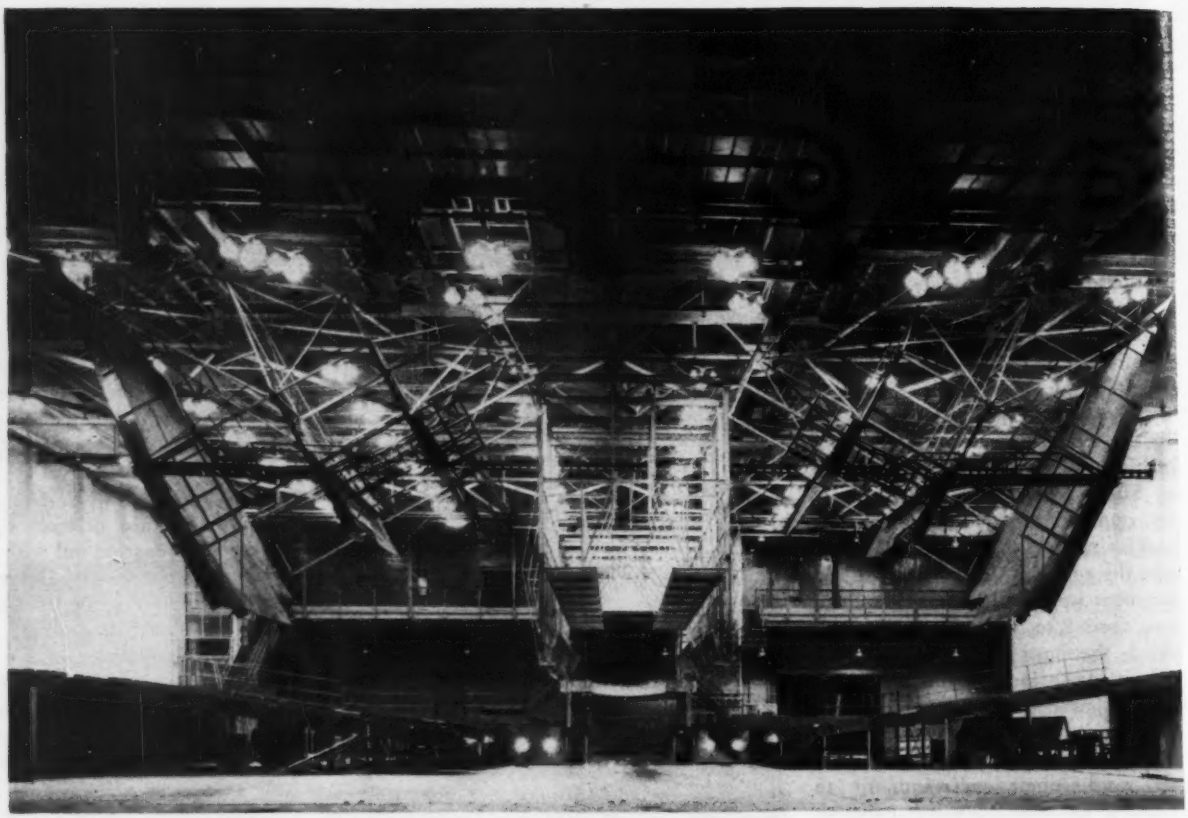
(3) Engineers and technical help are freed for new construction operations, which is extremely important during this period when state highway departments are short-handed.

(4) The regular maintenance forces are freed for work that does not lend itself to contract performance.

More planning required

To make contract maintenance most effective, certain precautions must be taken and more careful planning is needed for some operations. Work must be awarded in sufficiently large amounts to make it attractive to the contractors and thus secure good prices, specifications must place emphasis on results rather than methods, and maximum freedom must be allowed in the type of equipment used, so long as the desired results are secured. Calling for bids early in the year to permit completion in one construction season will increase the effectiveness of the contract method.

The success of the contract method on maintenance operations to date would indicate that this method should become a permanent tool of most highway maintenance departments.



ELECTRICALLY OPERATED DOCKS facilitate plane overhauling at United Air Lines San Francisco base.

Push-Button Maintenance

W. R. Engstrom
and
Frank W. Maynard

Respectively Vice President, Aviation Division, Cleveland; and Vice President and District Manager, Oakland; for The Austin Co.

WHEN a major airline invests millions of dollars in flight equipment, it must do an efficient job of moving pay loads throughout every possible revenue hour—if profit is to be made.

With this in mind, United Air Lines, in expanding its maintenance base at Mills Field on San Francisco Bay, emphasized the use of automatic equipment to achieve high overhauling efficiency.

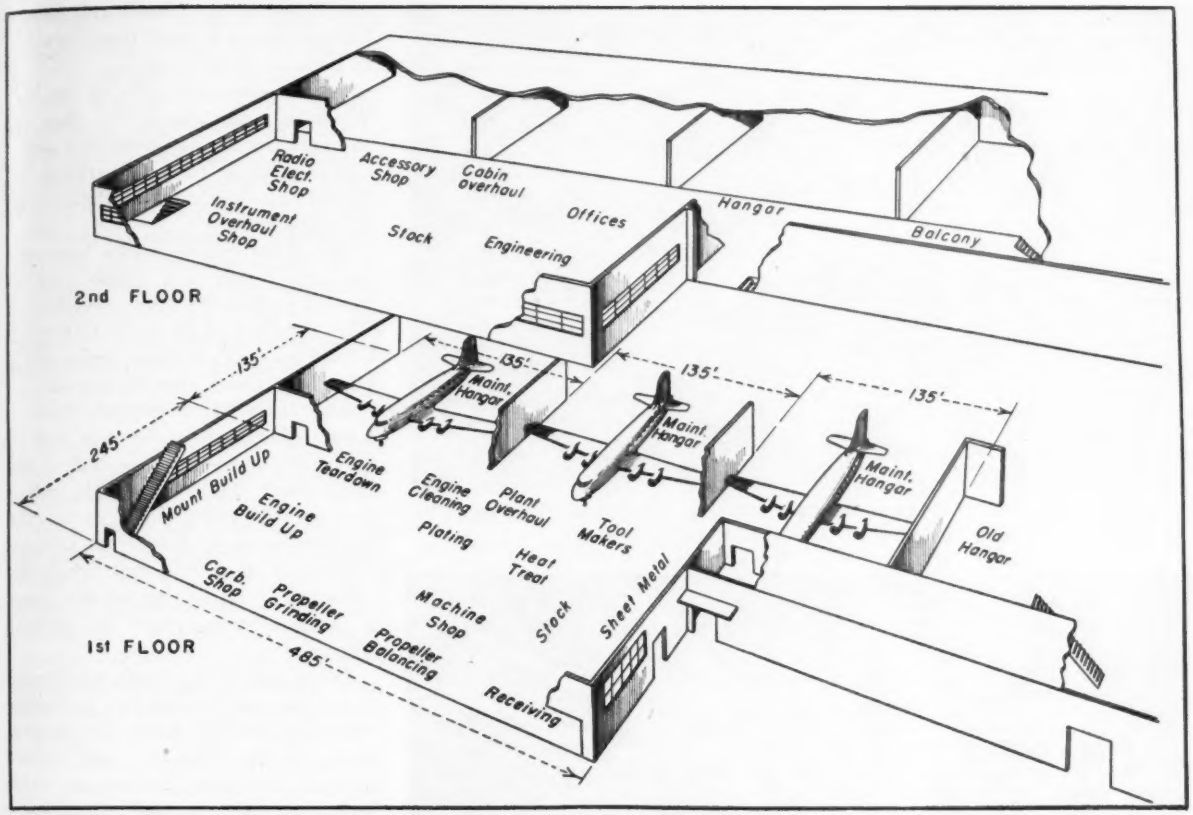
The new facilities, first ever built to accommodate the four-engine DC-6 Mainliners, are located at the central point of United's "long" routes, to obviate expensive deadheading. A total of 11 Mainliners, including new ones of advanced design that are still on order, can be handled simultaneously.

As dictated by the functional problem of dismantling, reconditioning and reassembling these Mainliners at prescribed intervals—with the least possible loss of revenue flight time per plane—the design integrates shops and hangars. The project includes a 245 x 485-ft. two story shop building adjoining three 135-ft. square hangars, an 82 x 200-ft. engine and carburetor test building and a boiler house adjacent to the shops.

Shops process 8 big engines per day

The first-floor area of the shop building is divided into engine overhaul, plane overhaul, plating, machine and sheet metal shops, to accommodate the heavier components of the Mainliners. The layout of these areas was determined by the requirements of their individual assembly lines and extensive conveyor systems; by their mutual relationship to each other, their accessibility to stock rooms, inspection and rework stations; and by the time element involved in moving components to and from the hangars. Except for the plating department, which is inclosed by masonry walls, the shop areas are separated by movable wire mesh partitions, which permit alteration of location and dimensions of the shops to meet future requirements.

Facilities for complete power-plant overhaul provided in the engine shop include a 1,280-ft. overhead chain conveyor of comparatively fast movement, a 160-ft. U-shaped, automatic cleaning tank and a 1,650-ft. slow-moving conveyor. There are also hydraulic lifts and elevators, requiring recessed floor installations. These, together with other equipment, enable the processing of eight complete 18-cylinder aircraft engines a day.



INTEGRATED SHOP AND HANGAR LAYOUT makes the most of automatic equipment to speed maintenance of airliners.

Base for Huge Airliners

The second-floor shop area provides for an engineer office and radio, electrical, instrument, cabin overhaul and accessory shops. The instrument repair shop is designed for complete air conditioning. Supplied with air filtered through electronic-type filters, the room is pressurized to prevent infiltration of outside air.

Midway between the first and second floors are mezzanines, consisting of four separate areas. They contain locker, wash, first aid, recreation and lunch rooms, foremen's offices and a complete photographic laboratory. Each mezzanine "island" was placed to provide direct access from the shop and hangar areas served by it, thereby holding traffic within the premises to a minimum.

Adjoining the shop building are the three 135-ft. square hangars, which have a clear height of 48 ft., separated from each other and from the shop building by a reinforced concrete fire wall. A balcony at the second-floor level and a ground-floor passage extending the length of the hangars, serve as continuous, interconnecting freeways, with fire doors between hangars and at shop-building entrances at both levels. Stairways, elevators, hydraulic ramps and mobile lift trucks provide vertical transportation to the balcony.

Vertical lift, canopy-type steel doors, 130 ft. wide by 35 ft. high, must be raised to permit access from the airport apron to the hangars. Push-button controlled, they are operated by a motor capable of opening or closing them in 15 sec.

The door height and other dimensions of the hangars were determined by the size of planes to be serviced. (DC-6's are 100 ft. 7 in. long and have a wing spread of 117 ft. 6 in.) The rudders of the DC-6's enter with 5 ft. to spare. The Boeing Stratocruisers, which will join the Mainliner fleet in 1949, have a folding device on the rudder post, which allows the 38½-ft. tail fin to clear.

Planes entering these hangars for overhauling are serviced from push-button-controlled maintenance docks from which all plane parts become accessible within 10 min. after an airliner is nosed into position. These docks are of light structural steel, with platforms of plywood to which a non-slip surface has been applied. The engine docks, nose docks and wing ramps are fixed, whereas a system of suspended docks provide access to the rest of the plane. These last are counter-balanced and positioned by ¼ to ¾-hp. electric motors.

Supported from the roof trusses, the fuselage docks are double-deck catwalks, which connect the nose docks with the empennage servicing structures, or tail docks. The lower deck is motor operated.

The tail docks, three stories high,

MAINTENANCE FACILITIES are centered in the large shop building (foreground) and the three hangars adjoining it in the rear.

FLAT-SLAB CONSTRUCTION, with a 22-ft. ceiling height, conveniently accommodates the extensive system of conveyors and monorails in the shops.

SAWTOOTH WELDED ROOF BENTS, spanning 40 ft., permit north lighting in the second-floor shops. Roof is insulated steel deck.

are hinged to the trusses and have a locking fixture to hold them securely in position after lowering. They fit snugly around each side of the tail. Weighing three tons apiece, they are so finely counter-balanced that application of paint to their surfaces required an equivalent addition of counterweight.

The fixed engine docks have two sets of covered pits, which may be opened so that the four propellers of either the DC-4 or DC-6 can be turned. Grated openings in these docks allow oil to be drained from the engines.

The cabin ramp extends from a lower balcony along the rear wall of the hangar to the fuselage dock at the cabin door. This ramp can be raised to serve the cabin door, or, as the airliner enters or leaves the hangar, lowered to clear the wings, while the retractable end section of the ramp is withdrawn to clear the plane's wheels.

Other major automatic equipment in the hangars includes two hydraulic elevators—one to serve the ground floor, lower balcony and upper balcony, the other the engine dock and upper balcony—and a 3-ton electric crane, which travels the full width of the hangar.

Safety and comfort of workmen using the hangars and dock structures were prime factors in design. Adequate guards and guardrails, mechanical and electrical interlocks, and multiple cabling of all suspended weights has reduced the formerly hazardous job of cleaning, stripping, dismantling, painting and reassembling of the planes to a routine task.

Heat for the hangars and parts of the shop building comes from a reinforced concrete structure adjacent to the latter. Originally an engine test building, this structure was converted to serve as a boiler house. One 30,000-lb. boiler with integral furnace was installed in each of the two former test cells, together with two 125-hp. air compressors and other accessories.

To replace the former test facilities, a new engine test building was constructed some 300 ft. beyond the shop building. It contains six engine test cells, arranged in pairs of two 16-ft. dia. tubes, placed horizontally and connected at each end with 16-ft. square 33-ft. high air-exhaust and intake shafts. Between each pair of

test cells is a control room with double panes of bullet-proof glass to allow observation of test engines.

Also located in the engine test building is a special unit for checking carburetor performance. Flight conditions, including altitudes up to 50,000 ft., are simulated through the use of 80 tons of equipment. Steam heat and air decompressors, used to reproduce either tropical-air or North-Pole atmosphere for both engine and carburetor tests, are provided among special facilities of the building.

Steps in overhauling an airliner

In general, here is the procedure that is followed in overhauling an airliner:

After the plane is towed into the hangar, the suspended maintenance docks are positioned by pushing a button. Engines are disconnected and electrically hoisted from their mounts, while radio and electrical equipment are being removed. Propellers are detached, cleaned, ground, polished and tested for balance.

Following a preliminary high-pressure spraying with steam and solvent, engines are taken to the tear-down sections of the overhaul shop, where they are disassembled. As tear-down progresses, electrical equipment is removed intact to the radio-electrical shops on the second floor for inspection and testing. Meanwhile gears, cylinders, pistons and sub-assemblies are carried by the 1,280-ft. overhead conveyor to a 160-ft. long hairpin-shaped washing tank containing 30,000 gal. of a strong detergent solution. The completely disassembled engines there undergo a 5-hr. series of sprayings and washings. Cylinders are subjected to an additional cleaning by air-pressure blasting.

After parts have been dried and tested, they are conveyed to the engine build-up shop for re-assembly. Finally, before being returned to the airliners, the overhauled engines are removed to the test-cell building for operation under conditions that simulate actual flying.

While this newly expanded maintenance base is considered to be the most advanced in existence, care was taken in its planning to provide for further growth. Although the hangars and shop building constitute a unit, they are completely independent of each other, both dimensionally and structurally. Future expansion of either, or both, can be made in the direction of the engine test building without disruption of the general plan.

Design and construction of the expanded maintenance facilities were accomplished by The Austin Company under the direction of Nicholas Boratynski, head of United Air Lines' design, buildings and airports department at Denver.

FLUORESCENT FIXTURES, flush with the acoustical ceiling and spaced 10 ft. apart deliver 60 ft.-candles in the engineering office.

STRUCTURAL AND ARCHITECTURAL DETAILS

Foundations—Concrete piles support walls and columns; composite piles, with wood below the groundwater line and concrete above, carry the floor.

Structure—The two-story, 245x485-ft. shop building has 9-in. thick, flat-slab floors designed for 125 psf. Columns are 22 ft. high, spiral-reinforced concrete, spaced 20x27 ft., in the first story. Sawtooth welded steel rigid frames, made of 14-in., 34-lb. wide-flange beams, spaced 27x40 ft., are used in most of the second story. Walls are concrete block to first-story window sills, corrugated asbestos-cement above. The roof is steel deck, insulated with glass fiber and topped with built-up roofing. Reinforced concrete walls inclose the 135-ft. square hangars. There the insulated steel-deck roofs are supported on steel purlins and 134-ft. span steel trusses, resting on concrete pilasters. The 82x200-ft. test house is of reinforced concrete construction. Windows have projected steel sash.

Conditioning—The first floor of the shop building is heated by overhead, projection-type, steam unit heaters; the second floor is heated and ventilated by specially designed units placed at each end of each sawtooth section to supply fresh, heated and filtered air during cold weather and to exhaust hot air during the summer. The photographic laboratory and engineering office are heated and ventilated using 100 percent outside air. Overhead revolving, steam unit heaters keep the hangars warm.

Lighting—In the shop building, fluorescent tubes recessed in the suspended acoustical ceiling are provided in the engineering office; deep-bowl, prismatic glass, three-lamp clusters of two 500-watt incandescent and one 400-watt mercury vapor in the heat-treating and plating areas; deep-bowl incandescent in the plane-overhaul area; and fluorescent troffers mounted 17 ft. 6 in. above the floor for general lighting. In the hangars, clusters as used in the plating areas are suspended 35 ft. above the floor and other lights are flush with the floors of the docks.

What's Wrong With—

Sanitary-Sewer Design Formulas? — — Part I

Benjamin Eisner • John F. Laboon • John W. Cunningham
I. Russell Riker • Thomas R. Camp

Editors Note — Design of sanitary sewers for a particular system should be based on actual flow measurements and not on straight-line formulas derived for other cities with dissimilar flow conditions. This contention was advanced by Richard Bennett, hydraulic engineer, City Engineer's Office, Phoenix, Ariz. in a recent article, "A Critical Appraisal of Sanitary-Sewer Design Formulas" (*ENR* Oct. 14, p. 102).

Keen interest not only in how sanitary sewers are being designed but also in how they should be selected is revealed by the number of comments on Mr. Bennett's article that have been received. Commanding major attention, the discussions by municipal as well as consulting engineers will be reported in a series of articles of which this is the first installment.

Some conclusions to be drawn from the discussions are: (1) Straight-line formulas improperly applied may lead to serious errors in selecting sewer sizes; (2) more sewer gagings are needed to improve design practices; (3) unit water consumption is a sound guide for sewage flows; (4) sewers must be proportioned for maximum and not average daily flow; (5) self-cleansing flows are as important in design as peak flows. Detailed comments follow.

Flow Composed of Many Elements

Benjamin Eisner
Chief Engineer, Clay Sewer Pipe Association
Columbus, Ohio

Mr. Bennett presents a justified criticism of so-called straight-line methods of estimating future sewer flows. He states correctly that there is need for more measurement of flow in existing sewers. In this connection, a description of the gauging procedures used at Phoenix to develop his "maximum rate of flow curve" would be most helpful to engineers.

The article makes several references to material appearing in *Clay Pipe Engineering Manual* on sewer-capacity design. The impression created by at least one of these quotations is that the manual recommends use of a straight-line design formula. The quoted material is: "It is common practice to base designs upon 100 gallons per capita average daily flow. This estimate should be used when more accurate data are unavailable and then with full understanding of its limitations. The 100-gallon estimate is safe only when considering large population areas."

Subsequently, it is stated that, at least for Phoenix, population density per acre is a minor factor. The general recommendation for sewer design offered by Mr. Bennett is that rate of expected maximum flow should be independent of population and decrease as a logarithmic function of tributary area.

Inconsistencies in the above appear readily on logical analysis. Excluding effect of infiltration, industrial waste or any other kind of flow except sanitary sewage, it would appear that per capita flow of sanitary sewage only must necessarily be less in large than in small areas. Until confirmatory evidence is offered, this conclusion must be considered as a judgment rather than a fact.

The gaugings charts for Phoenix and Louisville do not distinguish between various kinds of flow. To hold that population density (number of persons per acre) has but minor effect on total sewage flow lacks logical explanation. It is unthinkable that total sewage flow (all other things being equal) is the same for small as for large populations, both being contained within the same tributary area.

It is precisely in this connection that the *Clay Pipe Engineering Manual* recommends sewer-size determination as a total of sanitary sewage, industrial wastes, infiltration and reserves for future increase. Had Mr. Bennett quoted more completely from the manual, he might have included the following cautionary discussion: "When considering small areas, there are many variables which affect sewer-design calculations. For example, the character of the community may undergo changes during the life of the sewer. Population may become concentrated in small sections of the area served. An industrial plant having a large discharge rate may be constructed. Theaters or other institutions using large quantities of water for air conditioning may be connected to sewers. Industrial processes may change with considerable effect upon sewage flow. Such variations are innumerable and quite unpredictable." Designs based on considering all these factors would indeed result in deviation from straight-line flow estimates and would comply with Mr. Bennett's conclusion that per-capita total flow of all kinds from large areas is less than for small areas.

To the writer it seems that sewer design based on a single factor—such as gallons per acre per day—is subject to adverse criticism even though such a unit be made to decrease inversely with area. Mr. Bennett finds that there can be identical areas between which there is a great difference of total flow.

It seems far more logical, for proper sizing of sewer lines, to esti-

mate population, water consumption, industrial discharges and infiltration separately, and to design the sewer with sufficient capacity to discharge that total. If, as recommended by Mr. Bennett, sewer sizing is dependent only on a single estimate based on tributary area, likelihood of error is unnecessarily increased.

It is unfortunate that sewer gagings are so difficult and expensive to make. Even a host of gaugings would be of doubtful value without a corresponding study of tributary population, water-use habits, industrial operations and probable rates of infiltration. Sewer designers must exercise critical judgment in anticipating future sewage flows. To do so on any other basis than analysis of each recognized factor influencing the total, seems to be in the direction of rule-of-thumb rather than engineering logic. A forecast of sewage flow which takes into account each element of the total is to be desired over one based on any single yardstick—such as area served.

Sewage Flow vs. Water Consumption

John F. Laboon
Chairman of the Board and Chief Engineer
Allegheny County Sanitary Authority
Pittsburgh, Pa.

The commendable article "Sanitary-Sewer Design Formulas" presents a useful analysis of current design practices and demonstrates the hazard of applying general formulas to specific problems. The writer agrees generally with Mr. Bennett's conclusions, and particularly with the statement that use of a straight-line formula may result in serious errors when applied to conditions other than those for which the formula was developed.

The Allegheny County Sanitary Authority in 1946 measured flow at 35 selected outfall sewers in Pittsburgh and neighboring municipalities serving an area of 31,000 acres and a population of 678,000. Included were commercial districts in downtown Pittsburgh, and mixed commercial, light industrial and residential, and entirely residential areas. The weirings represented dry-weather flow in combined sewers.

Average sewage flow including infiltration for the whole area was 95 gal. per capita per day or nearly 2,000 gal. per acre per day. Since almost all wastes from large industries is discharged directly into streams, very little industrial flow is included in the quantities measured in municipal sewers. Groundwater infiltration into the 1,065 miles of sewers tributary to weirs was calculated at 18,600 gal. per mile per day or 638 gal. per acre per day.

Flow from the 51-acre commercial district was 5,200 gal. per capita per day or 43,800 gal. per acre per day; from mixed commercial and residential areas—121 gal. per capita per day or 2,350 gal. per acre per day; and from a low-income residential area—45 gal. per capita per day or 1,395 gal. per acre per day.

Detail studies were made of sales by 51 water agencies serving the Authority area so that groundwater infiltration could be determined to a reasonable degree of accuracy.

Water sales to 1,468,000 consumers for the highest quarter of 1945 averaged 98 gal. per capita per day. This includes commercial and some industrial customers but not large industries with private water systems. Domestic water customers used 134 gal. per day per meter or 35 gal. per capita per day.

Weir measurements developed that the highest average daily flow equalled 110 percent of the average week and maximum hourly flow was 150 percent of the average daily flow for an entire week. Rate of peak flows varied from 1.2 to 1.7 of the average daily flow for an entire week.

The above data for Allegheny County municipalities demonstrates the impracticability of rule-of-thumb design or design by flow curves developed for other communities and properly bears out Mr. Bennett's contentions.

Plotted results of the flow measurements for various areas reveal no uniform pattern even with respect to curves developed for Louisville and Phoenix, further bearing out the need for study of each area to be served by sanitary sewers. The Louisville curve could be used safely for design of all areas weired in Allegheny County excepting strictly commercial districts. Main interceptor designs, however, interpose the factor of time especially in long interceptors, such as are proposed in the Authority program. In this case, peaks are averaged out to a maximum of 125 percent of the average daily flow for an entire week as opposed to actual findings of 150 percent peaks for individual areas.

Future Loadings Justify Liberal Design

John W. Cunningham
Consulting Engineer
Portland, Ore.

The article is a worth-while contribution to sewer-design literature. I fully agree with Mr. Bennett that generalized data have little value, except possibly as a rough check on methods. Each community, and in fact each sewered area, should be given special study. However, sewers can never be designed as precisely as other engineering structures. Safety factors must be liberal.

Sewers have long lives. Where they are deep down under paved streets, it is costly to replace or relieve them. In a rapidly growing western community, the engineer has often seen land use go through the cycle of single-family residences, multiple housing, commercial and industrial occupancy with original sewers doing service. He needs a crystal ball to supplement his mathematical approach.

First information to be sought is use of water because domestic sewage is always definitely related to water use. Effect of irrigation must be eliminated by studying only water use during winter or non-irrigating months. Special situations, which affect the transition from water to sewage must be considered.

On the plus side, where any portion of the sewer is below groundwater level, is leakage or infiltration. This may be, and unfortunately often is, a material factor. Imperfect construction of the sewer and poor house connections will often result leakage

in excess of sanitary flow. If the design engineer supervises sewer construction, he can at least insure good workmanship. But he has little control of what plumbers may do in the future.

Sewers must be proportioned for maximum rather than average daily rate of flow; the maximum is usually 130 to 140 percent of the average.

Mr. Bennett's studies bring out the well-recognized reduction of per-acre or per-capita sewage flow for large as compared with small areas although I doubt if a ratio as large as 3 to 1 for 50-, compared to 1,500-acre areas can be supported in general experience. This effect arises from diverse user habits of and the time required for sewage to pass from the head of a sewer to its outlet. Electrical engineers have a name for flow variances that I have seldom, if ever, seen used with reference to water or sewage—"*diversity factor.*" In studying a sewer district, the engineer should consider not only area but also length of sewer and shape of the district, using methods similar to those applied in the "rational method" of storm-sewer design.

In working out the design basis for the Portland, Ore. intercepting sewers, the writer studied the effect of 52 separate trunks with junctions distributed in more than 14 miles where the maximum travel time is 8 hr. Reduction of the cumulative daily peak, compared with the total of simultaneous peaks, was only about 5 percent because larger sewers entered the interceptor in a group. If they had been spread out, the leveling effect would have been more pronounced.

Another reason for designing small sewers more liberally than large ones is that effect of unforeseen future loadings from commercial or industrial sources is more serious. A new food-processing industry located on an 8-in. sewer might completely overload it, while the discharge in a 30-in. sewer would be hardly noticed.

Infiltration Causes Over-loading

I. Russell Riker
Borough Engineer
Princeton, N. J.

I agree with Mr. Bennett that estimated sewage flow does not only vary considerably in different sections of the country but also in different parts of a particular state.

To set out a minimum for examination of plans, Rules and Regulations of the New Jersey State Department of Health specifies an 8-in. minimum size and the minimum fall of 0.4-ft. per 100 ft. for glazed tile, concrete, brick, or segmental-block sewers and 0.24 ft. for asbestos, enamel-iron or cast-iron pipe. Minimum design flow must not be less than 20 gal. per foot and the sewer must be large enough to carry twice estimated average flow 25 years hence when flowing half-full.

Other requirements under the section on sewage treatment plant have a bearing on the sewer system. A minimum average flow of 100 gal. per capita per day to which must be added industrial wastes is specified. With these quantities bituminous joints or equal must be used in the sewer system; otherwise the unit rate must be increased by 25 percent. These minimums may be rather high and according to Mr. Bennett would be uneconomical. Yet many design elements are so difficult to determine that the factor of safety must be sufficient to meet unforeseen conditions. There may be certain instances where low per-capita water use will increase substantially after construction of a sanitary sewer. This is so because the people are fearful of overtaxing private sewage systems. In addition, actual infiltration may vary considerably over the estimated amount, particularly when water table is high.

I am not too concerned about lateral sewers because an 8-in. sewer on minimum grade will carry 270,000 gal. per 24 hr. flowing one-half full. This is much more than the maximum future flow which may have to be carried.

Sub-trunks and trunks need careful study. I agree with the author that an arbitrary figure for these sewers should not be used. However, the factor of safety should be adequate because it is much more expensive to build a supplementary sewer than to make it larger in the beginning. About the only appreciable item in original work is the additional cost of the larger pipe. This is, however, a minor consideration.

I have emphasized time and again the importance of requiring the tightest pipe-line joints and including a positive test for tightness in specifications. Practically every case of sewer over-loading in the past 30 years has been caused by excess infiltration.

Minimum Flows Are Important

Thomas R. Camp
Consulting Engineer
Boston, Mass.

The article implies that it is common practice to estimate sewage flows for design of sanitary sewers by empirical formulas without recourse to flow measurements in existing sewers. If this is true, it is very bad practice and is bound to lead to trouble. Sewer gagings are essential to sound design.

We find that water consumption is an excellent guide to expected sewage flows provided due allowances are made for groundwater infiltration, and municipal water and private-supply water (principally industrial) that does reach the sewers. In design, the average daily flow of sewage (for the entire year) exclusive of ground water is an excellent base upon which to project minimum and peak flows. Average daily flow can be correlated with water consumption and population but it is wholly inadequate alone for sewer design.

Sewer design should be based on minimum flows and peak flows. For very large sewers, the ratio of peak to extreme minimum flow may be less than 3 to 1 whereas for small areas the ratio may exceed 20 to 1. In laterals serving a few houses, flow (exclusive of infiltration) may be zero at night and may increase to rates as high as 3,000 gal. per capita per day after flushing of toilets.

If sewers are to be made self-cleansing, minimum flows are just as important in design as peak flows. Slope of the sewer should be such as to produce scouring velocities for at least half the day and the size should be adequate for peak flows to be expected at the end of the design period.

READER COMMENT

Overtime Pay

Sir: It does not appear from your story on the recent Supreme Court ruling on the "Overtime on Overtime" (*ENR* Oct 21, 1948 p. 5) that only those construction firms which are engaged in interstate commerce are actually affected by this ruling. I think you will agree that this important aspect of the case should be given the emphasis it deserves.

Coverage of construction workers under the Wage and Hour Laws is determined by the type of work done by the individual worker and also by the nature of the construction project on which the work is done. If the work is original construction work, it may safely be said that manual workers on such projects are not covered, while on repair, alterations, and reconstruction, they may be covered, if the work is being done on a plant or other facilities of a manufacturing or similar type of company, which is itself engaged in interstate commerce. It is also possible that even on new and original construction, some of the workers, who may themselves be engaged in work in the stream of commerce may be covered, but this only affects the individual worker and does not render the whole project subject to the law.

MILTON E. FRIEDLAND
Attorney at Law
New York City

Building Code Reform

Sir: Your editorial, "Building Code Drafting Troubles" (*ENR* Sept. 30, p. 47), contains one or two conclusions that we find difficult to support by fact. The Building Officials Conference of America, Inc., whose basic building code committee has drafted the instrument to which you referred, recognizes full well—contrary to what you say—that architects, engineers, contractors and materials manufacturers do have important contributions to make in the way of bringing about building code reform and uniformity. Innumerable opportunities have been afforded them to make their contribution.

You say that manufacturers have "objected to many provisions" and have no guarantee that their recommendations will be accepted. Obviously, with diverse and often diametrically opposed points of view expressed, how could every manufacturer be given a guarantee that his particular recommendations would be accepted? All recommendations were weighed carefully in the light of engineering principles and practices, and where differences have been found based on accepted practices, these have been reconciled.

Whether industry feels that its subscriptions to the Building Officials Foundation are in the nature of gifts to BOCA, as you say, we have no way of knowing. It is our general impression, however, that the BOF subscribers want to bring about building code reform, and it is for this reason that they have supported it. BOCA does not receive one cent of this money and it seems reasonable to suppose that hard-headed business men subscribing from $100 to $5,000 each are under no delusion that they are making gifts to BOCA.

The next objective of BOF, now that the code nears publication, is to set up a structural bureau, staffed with competent engineers, to give substance to BOCA's basic building code in administration. Once that bureau is in operation, BOF will be self-sustaining through fees for its services, as you suggest. This procedure was contemplated from the beginning. This is not a grandiose heavily financed scheme, as you say, but a very practical one, arrived at after long and very careful consideration.

Obviously, the test of a good code is one "that is easy to enforce," but this is not the only criterion. The objective is standard safe building construction based on minimum functional performance standards insofar as practicable. The program has had the endorsement of outstanding architects, builders, engineers and producers. Some criticism has come from the "technical specialists of material manufacturers," presumably for no other than selfish reasons. The building officials desire the wholehearted, unselfish cooperation of all segments of the industry without creating either a privileged minority or a controlling autocracy. Obligated as they are with the legal responsibility of enforcing safe building construction, they are entitled to the guidance of a good, workable building code.

The BOCA-BOF program has accomplished more for building code reform in two years at a total cost of $75,000 than all our government and other endowed agencies have accomplished in twenty-five years with expenditures running into the millions. Would you still say, the BOCA-BOF program is a grandiose scheme?

JAMES H. MOONEY
President, Building Officials Conference of America, Inc.

JOSEPH P. WOLFF
Chairman, Board of Governors
Building Officials Foundation
New York 17, N. Y.

Articulated Bridge Spans

Sir: The statement of Mr. Bergendoff, contained in *ENR*, Sept. 30, 1948 p. 80, under Reader Comment, implies that articulated design was introduced into the state of Mississippi by the firm of Ash, Howard, Needles & Tammen with the construction of their Greenville bridge in 1940.

The State Highway Department was building bridges in Mississippi involving that particular feature ten years before the Greenville bridge was constructed. These were relatively smaller structures, however, and were not regarded of sufficient importance to warrant large scale publicity.

Our principal objective at the time was use of that method as a means of gaining additional span length with rolled beam designs, and the other advantages resulting from the arrangement were more or less consequential.

Other states have no doubt used this feature to a certain degree in the more convential type cantilever suspended span designs. I am sure it was not the intention of the editor in his article on our Yazoo River bridge to credit anyone individually for originality of the design, but rather to emphasize the unusual extent to which it was employed in that particular bridge.

In a design of that type, one end of each span is supported from the cantilevered end of the adjoining

span, and each span is thus dependent upon its adjacent span for support. Unless proper means are provided, it is possible in such an arrangement that the loss of one span may cause complete loss of the entire bridge. In the instance of the Yazoo River bridge, we introduced at certain intervals a span resting on two bents and having both ends cantilevered, with no dependency on its adjacent spans for support.

Although there may be only a remote possibility, we strongly recommend the provision of appropriate means to render a bridge involving that type of construction less vulnerable to loss or destruction.

C. S. HILL,
Bridge Engineer,
State Highway Department,
Jackson, Miss.

Clay of Berlin

Under this title *The New York Times* of Oct. 22 carried the following editorial. It is such a well-deserved tribute to a civil engineer who is handling one of the world's toughest jobs with great distinction that we are glad to reprint it in full. General Clay, it is interesting to note, was elected last month to honorary membership in the American Society of Civil Engineers.—*Editor*

"If we had in this country the British system of awarding titles to our military men and allowing them to pick their own, a British example being Viscount Montgomery of Alamein, it is possible our commander in Germany would be known to history as Viscount Clay of Berlin. For if there is one name that comes quickest to mind to stand as a symbol of Western firmness on the question of forced withdrawal from the German capital it is that of Gen. Lucius D. Clay, the United States representative there. A 'victory' for the West in the Berlin crisis would be peculiarly his own and, in the long view of history, perhaps even more important than the military one won in Africa from which Britain's leading field officer took his title.

"During his long Army career, from his graduation from West Point in 1918, General Clay has gained recognition as the Army's top trouble shooter. If there was at hand a tough construction job, or reconstruction job, he was the man to do it. From Manila to Cherbourg he always delivered, whether it was building a dam, a hydroelectric plant, clearing a French harbor, or cracking down on United States manufacturers who wanted to reconvert to peace before the war was won. But probably he never envisioned as tough a task as that he has been discharging so well for the last two years.

"Since the Russian blockade of Berlin was put into effect last summer it is no exaggeration to say that General Clay's job has been just about the most important in the world. There must have been many times during these weeks of strain when decisions by a less able representative could have precipitated an incident that might have led to catastrophe. Through it all General Clay has given an impression of calm firmness that has been good for the nerves of the democratic world, as it must have been disconcerting to the Russians. The more tense the situation the calmer he became, without in any way retreating from the Western position that Berlin must remain under Four Power control. Although other men did the work of organization, the responsibility of instituting and expanding the airlift—the effective counter to the Russian blockade—was his.

"New York honored itself in asking him to deliver the main address at the Alfred E. Smith Memorial Dinner last night. We hope that the respect and enthusiastic approval of him, implicit in the reception he received, will send him back to Berlin with the feeling that a united country is behind him."

U. S. Reconstruction in Greece

Sir: Recalling your earlier reports on Greece, a program report may be in order. For the past fifteen months I have been handling the reconstruction work for Atkinson-Drake-Park, joint venturers in Greece and here is what is happening:

Highways—We are attempting to asphalt surface 1,800 kilometers of highway by Jan. 1, 1949. This work is being done by three methods. We have five 100 ton per hour Barber-Greene asphalt plants making hot mix and four Woods Roadmixers, Model 36, self-propelled, travelling type. The third method we are using is asphalt penetration. The roads, of course, are in very bad shape from years of misuse and lack of maintenance, and a tremendous amount of work is done on the sub-base before paving.

Very little attempt has been made to relocate or realign these roads, due to the necessity to open up the highways. In addition to the usual engineering and construction problems we have had considerable harassment from the guerillas and have been operating a great deal of the time in the so-called insecure area. Some of our asphalt plants have produced as much as fifteen hundred tons of asphaltic concrete per shift, and we think that we have given the Greeks some idea of American initiative and know how.

Airfields—We have built five new airfields and rehabilitated two. We completely repaved the main runway at Hassani, the international airport, and have done considerable other work in this location. The new airfields are located at Kavella, Salonica, Kozani, Ioannina and Tripolis. Rehabilitation work was done on the airfield at Larissa. Some of these airfields are asphalt and some are steel pierced plank, similar to the type we laid so much of in the Pacific. The airfield program is substantially complete.

Railways—Under the railroad program we are reopening the rail line from Athens to Salonica and replacing some of the bridges on the line from Salonica to Alexandroupolis. In addition to this, there is some bridge work assigned to us on the lines from Salonica north into Yugoslavia. Our major railway work is near the Lamia area where we are reopening a 2,000 meter tunnel which was badly blown in three places by the Germans. In this area we are also building one new rock tunnel. Most of this work is scheduled to be completed by Jan. 1, 1949.

The Atkinson-Drake-Park contract is with the War Department for approximately sixty-four million dollars. It is being administered by the Corps of Engineers with Colonel D. W. Griffiths, Engineer of the Grecian District.

W. L. PAINTER
Project Manager
Atkinson-Drake-Park
Athens, Greece

UNIT PRICES BID BY CONTRACTOR

Watermains, Reading, Ohio

OWNER: City of Reading, Ohio; Alfred LeFeber, Cincinnati, consulting engineer.

PROJECT: Installation of 12 inch low service and 8 inch high service watermains in Reading, Ohio. The project to include excavating, laying of pipe, and repaving of streets and resetting of manholes, five hydrants, sidewalks.

CONDITIONS: The owner to furnish the cement lined cast iron pipe. Contractor to furnish all other materials, tools, labor, transportation, and machinery. The contractor shall commence work within 10 days after execution of the contract. Access to the job site is available by highway. Average hourly wage rates are: skilled, $1.93; hod carriers and common labor on heavy construction, $1.33; operating engineers on heavy construction, $1.69.

LIST OF BIDDERS:

1. Bond and Sheehan, Cincinnati, Ohio $42,782.95
2. H & W Construction Co., Cincinnati, Ohio 44,940.10
3. Byrnes-Conway Co., Cincinnati, Ohio 49,787.00
4. Crumley, Jones, & Crumley, Co., Cincinnati, Ohio 54,689.00
5. McManus & McCarthy Inc., Reading, Ohio 55,093.00
6. Vest & Bartell, Cincinnati, Ohio 56,441.70
7. Verderber Constr. Co., Toledo, Ohio 59,651.50

	Item	Quantity	Unit Prices (1)	(2)	(3)
1a	4" Class "C" C.I. Pipe (Laying)	180 lf	2.00	1.00	3.00
1b	8" Class "C" C.I. Pipe (Laying)	20 lf	5.00	2.00	4.00
1c	8" Class "C" C.I. Pipe (Laying)	3,400 lf	1.25	.80	1.90
1d	12" Class "C" C.I. Pipe (Laying)	6,500 lf	2.15	2.40	2.40
1e	16" Class "C" C.I. Pipe (Laying)	1,275 lf	2.55	3.00	3.00
3	C.I. Fittings (Laying)	15 tons	40.00	65.00	125.00
4a	4" Gate Valves	6 ea	37.00	50.00	60.00
4b	6" Gate Valves	7 ea	55.00	60.00	70.00
4c	8" Gate Valves	2 ea	79.00	100.00	100.00
4d	12" Gate Valves	11 ea	185.00	250.00	225.00
4e	16" Gate Valves	1 ea	490.00	600.00	600.00
4f	10" Tapping Tee and Valve	1 ea	350.00	400.00	300.00
4g	10" Tapping Cross and Valve	1 ea	633.00	500.00	325.00
5a	Class 1 Concrete	5 cy	45.00	10.00	50.00
5b	Class 2 Concrete	10 cy	20.00	10.00	30.00
5c	Class 3 Concrete	75 cy	12.00	10.00	15.00
6	Reinforcing Steel	1,000 lb	.15	.10	.20
7	Brick Masonry	5 cy	50.00	40.00	50.00
8	Work on Existing Mains	Lump sum	1,000.00	4,500.00	500.00
9a	Black Top Repaving	1,900 sy	3.00	2.00	2.50
9b	Concrete Repaving	30 sy	12.00	5.00	6.00
9c	Gravel	25 sy	.50	1.00	1.00
9d	Sidewalk	1,400 sf	.40	.40	.50
10	Valve Chambers	17 ea	125.00	120.00	150.00
11	Sheeting Left in Place	10 MBM	.02	.01	.10
12	Valve Boxes	13 ea	17.00	30.00	35.00
13	Valve Box Extensions	25 lf	3.00	2.00	5.00
14	Special Excavation	100 cy	6.00	1.00	15.00
18	Fire Hydrants	6 ea	175.00	150.00	200.00
19	42" Corrugated Pipe Conduit	24 lf	50.00	50.00	18.00
20	Brick Manhole	1 ea	180.00	350.00	250.00
21	Hauling Pipe and Fittings	466 ton	2.50	2.50	4.00

Irrigation System, Pipe Line Lewiston, Idaho

OWNER: U. S. Department of the Interior, Bureau of Reclamation, Lewiston, Idaho; W. L. Karrer, construction engineer.

PROJECT: Construction of irrigation system and main pipe line from station 0+15 to station 232+30 at the Lewiston Orchards Project, Lewiston, Idaho. The job includes excavation for and installation of 36½ inch and 30½ inch outside diameter pipe.

CONDITIONS: All materials for construction and testing to be furnished by the contractor. The contractor to begin work 30 calendar days after the date of notice to proceed and the job to be completed within 210 calendar days of such notice. Access to the job site is available by highway. Prevailing hourly wage rates are: skilled, $1.65 to 2.35; semi-skilled, $1.30 to 1.65; common, $1.00 to 1.20.

LIST OF BIDDERS:

1. Goodfellow Bros., Wenatchee, Wash $344,552.50
2. J. F. Konen, Lewiston, Idaho 357,461.41
3. Scheumann & Johnson, Seattle, Wash 394,817.50
4. Mansen & Parr Const. Co., Spokane, Wash 399,188.50
5. A. B. C. Construction Co. Paramount, Calif 418,271.00

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Common excavation	23,300 cy	$1.50	$.40	$1.50
2	Rock excavation	600 cy	4.00	2.00	5.00
3	Backfill	19,300 cy	.80	.20	1.00
4	Compacting backfill	5,400 cy	.80	2.00	2.00
5	Concrete in structures	23 cy	100.00	60.00	70.00
6	Furnishing and placing reinforcement bars	1,400 lbs	.20	.12	.15
7	Furnishing and handling cement	155 sacks	1.50	1.50	1.50
8	Dry-rock paving	150 sy	5.00	15.00	10.00
9	Furn. and install 30½ in. outside diam. pipe	4,450 lf	14.00	15.44	14.50
10	Furn. and install 30½ in. outside diam. pipe	18,900 lf	11.00	13.16	13.00
11	Furnishing and installing one 36½ in. outside diam. by 30½ in. outside diam. reducer	lump sum	500.00	422.11	500.00
12	Furnishing and installing manholes	15 ea	500.00	480.00	500.00
13	Furn. and install airvalve assemblies type A1	2 ea	600.00	564.00	700.00
14	Furnishing and installing airvalve assemblies type A2	3 ea	300.00	216.00	250.00
15	Furnishing and installing nozzle type N2	1 ea	500.00	400.80	500.00
16	Furnishing and installing nozzles type N3	5 ea	120.00	75.60	90.00
17	Furnishing and installing nozzles type N4	7 ea	200.00	138.00	150.00
18	Furn. and install 1½ in. service connections	60 ea	10.00	9.60	4.00
19	Furnishing and installing misc. metalwork	1,200 lbs	.40	.24	.50

Waterworks Improvements, Liberal, Kansas

OWNER: City of Liberal, Kansas; Phil Minner, city manager; H. R. Hunter, consulting engineer.

PROJECT: Construction of additional water lines and a one million gallon tank on a 70 foot tower. The tower designed for 150 MPH wind stress.

CONDITIONS: All materials to be furnished by the contractor. Estimated completion time is 12 months from date of contract. Access to site is available by highway. Prevailing hourly wage rates are: skilled, $2.00; common, $1.00.

LIST OF BIDDERS: *Contract awarded

1. *Burt and Binford, Hutchinson, Kansas $353,862.27
2. W. B. Carter, Wichita, Kansas 369,030.00
3. H. J. Taylor, Salina, Kansas 403,620.00

	Item	Quantity	Unit Prices (1)*	(2)	(3)
1	C. I. pipe in place—10"	18,500 lf	$5.20	$5.40	$6.00
2	C. I. pipe in place—8"	20,500 lf	4.18	4.40	5.00
3	C. I. pipe in place—4"	200 lf	2.32	2.50	2.80
4	CIP remove and relay—4"	1,900 lf	1.43	2.00	2.00
5	CIP remove and relay—8"	450 lf	1.72	2.20	2.50
6	Valves hub end and box—10"	5 ea	164.00	170.00	185.00
7	Valves flanged—10"	3 ea	159.04	160.00	175.00
8	Valves hub end and box—8"	18 ea	82.80	85.00	90.00
9	Valves flanged—8"	3 ea	97.75	100.00	100.00
10	Altitude valve and box—10"	1 ea	1,137.55	1,200.00	1,000.00
11	Altitude valve and box—8"	1 ea	1,007.20	1,100.00	800.00
12	Valves hub end and box—6"	5 ea	79.12	80.00	85.00
13	Valves hub end and box—4"	50 ea	56.75	60.00	65.00
14	Valves hub end and box—3"	4 ea	49.50	50.00	50.00
15	Screwed valves—2"	5 ea	27.20	30.00	25.00
16	Fire hydrants	16 ea	132.65	140.00	150.00
17	Cast iron fittings	18 tons	400.00	400.00	450.00
18	One million gallon steel tank on 70 ft. tower	1 ea	149,900.00	155,000.00	165,000.00
19	Concrete pipe encasement	5 cy	20.00	18.00	25.00

Storm Sewer Trunk, Great Falls, Montana

OWNER: City of Great Falls, Montana.

PROJECT: Construction of a storm sewer trunk which will run North on Seventh Street from Central Avenue to the Missouri River. The project to include 15,700 cubic yards of excavation and back fill, which includes 475 linear feet of tunneling; laying, finishing and jointing the pipe; setting manholes; and replacing the pavement. Where sanitary sewers intersect the storm sewer, cast iron soil pipe is to be used to replace existing vitrified pipe of the sanitary sewer.

CONDITIONS: Contractor to furnish all labor and material. The project to be completed within 8 months after execution of the construction contract except that replacement of the pavement may be delayed until the summer of 1949. Temporary gravel street surfacing shall be installed and maintained until permanent resurfacing is completed. Access to the job site is available by highway. Prevailing hourly wage rates in nearby Helena are: bricklayers, $2.00; plumbers, $2.25; power shovel operators, $2.00; truck drivers, (trucks over one-and-a-half tons), $1.50; and common labor on heavy construction, $1.38.

LIST OF BIDDERS:

1. Utility Builders, Great Falls, Mont. $273,972.85
2. Robertson & Cave, Great Falls, Mont. 289,830.25
3. McLaughlin, Inc., Great Falls, Mont. 290,903.80
4. S. Birch & Sons, Great Falls, Mont. 294,990.00
5. Kiely Construction Co., Butte, Mont. 298,361.50

	Item	Quantity	Unit Prices: Engineer's Estimate	(1)	(2)
1	Excavation				
	a. Excavation and backfill	6,200 cy	$7.50	$8.90	$5.00
	b. Soft rock and backfill	5,700 cy	9.00	6.90	9.95
	c. Hard rock and backfill	2,600 cy	12.00	9.90	9.95
2	Furnishing, laying and jointing pipe				
	a. 60" dia. pipe	1,415 lf	27.84	30.52	32.65
	b. 48" dia. pipe	1,600 lf	18.47	22.54	20.45
	c. 42" dia. pipe	1,210 lf	14.35	18.82	16.10
	d. 15" dia. pipe	215 lf	3.13	5.26	3.80
	e. 12" dia. pipe	520 lf	2.24	4.88	2.75
	f. 10" dia. pipe	375 lf	2.00	4.23	2.05
	g. 6" dia. pipe	100 lf	1.50	2.62	1.25
	h. 42" to 48" increaser	1 ea	120.00	264.00	305.90
	i. 48" to 60" increaser	1 ea	128.00	339.00	382.00
3	Manhole, std. 6'-8' ht.	1 ea	300.00	252.00	221.00
	42" x 48" mandole 8'-10' ht.	1 ea	400.00	374.00	383.00
	42" x 48" manhole 10'-12' ht.	1 ea	500.00	461.00	445.00
	42" x 48" manhole 14'-16' ht.	1 ea	550.00	585.00	522.50
	48" x 48" manhole 16'-18' ht.	1 ea	600.00	645.00	594.00
	48" x 48" manhole 20'-22' ht.	1 ea	650.00	705.00	686.00
	48" x 48" manhole 22'-24' ht.	1 ea	675.00	782.00	733.00
	48" x 48" manhole 24'-26' ht.	1 ea	700.00	859.00	778.00
	60" x 48" manhole 10'-12' ht.	2 ea	800.00	597.00	563.50
	60" x 48" manhole 12'-14' ht.	1 ea	875.00	677.00	610.00
	60" x 48" manhole 14'-16' ht.	1 ea	900.00	754.00	656.00
	60" x 48" manhole 18'-20' ht.	1 ea	950.00	903.00	737.60
4	Inlets				
	a. Corner	22 ea	200.00	180.00	98.60
	b. Side	25 ea	200.00	193.00	144.00
	c. Removal of exist.	30 ea	25.00	29.00	12.00
5	Pavement replacement				
	a. Concrete	200 cy	25.00	26.00	42.00
	b. Asphaltic paving	175 tons	10.00	14.00	23.20
6	Shoring, lumber	10 MFBM	300.00	145.00	175.00
7	Concrete				
	a. Concrete	75 cy	50.00	29.00	28.00
	b. Curb removal and replace	75 lf	2.50	2.70	4.00
8	Trench gravel, in place	375 cy	5.00	5.00	7.00
9	Tunneling				
	a. Excavation	823 cy	20.00	10.50	13.65
	b. Soft rock	703 cy	20.00	10.50	17.20
	c. Hard rock	320 cy	20.00	15.00	20.50
10	Outfall				
	a. Structural excavation	150 cy	10.00	12.00	42.50
	b. Concrete	58 cy	50.00	58.00	58.00
	c. Reinforcing steel	4,400 lbs	0.15	0.14	0.26
	d. Untreated timber piling 10" to 12" dia.	60 lf	4.50	5.00	6.80

Complete Sewage System, Grahamsville, New York

OWNER: City of New York, New York; Roger W. Armstrong, chief engineer.

PROJECT: Construction of a sewerage system, comprising a collecting system and disposal works, to collect and treat the house sewage of the village of Grahamville, Sullivan County, N. Y. and vicinity. The collecting system will include about three miles of main sewers and two miles of house connections, laid to the outside of foundation walls of buildings. The main sewers will be, in general, eight inches and ten inches and the house connections six inches in diameter. About 88 per cent of the main sewers are located in highways or on lands owned by the city and the remainder in rights-of-way through private property. The system is intended to eliminate most of the pollution that would otherwise enter Chestnut Creek which now furnishes a part of New York City's water supply.

CONDITIONS: All labor, materials, and equipment to be furnished by the contractor. The contractor shall commence work within 10 days after service of notice to begin; and shall complete the disposal plant, including the water supply system and main sewer with house connections, within 12 consecutive calendar months and the total job within 18 months. Access to the job site is available by highway. Stipulated hourly wage rates are: skilled, $1.375 to $2.375; semi-skilled, $0.75 to $2.25; and unskilled, $1.15.

LIST OF BIDDERS:

1. DiMarco & Ciccone, Inc., White Plains, N. Y. $745,815.00
2. Melwood Construction Co., New York City, N. Y. 895,830.00

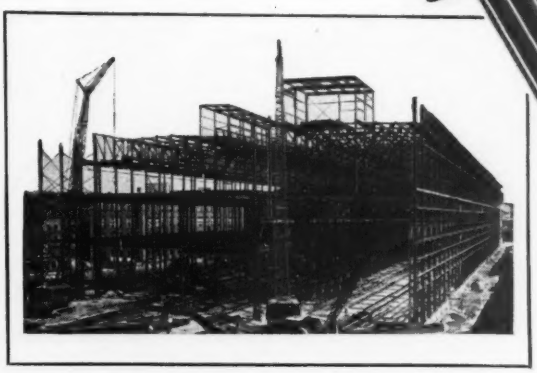
	Item	Quantity	Unit Prices: (1)	(2)
1	Removal of soil	5,500 cy	$1.05	$2.00
2	Earth excavation	16,000 cy	2.00	2.25
3	Refilling and embanking	15,000 cy	1.00	.50
4	Surface dressing and grassing	2,400 cy	3.00	1.50
5	Earth excavation and refilling of pipe trenches less than eight feet in depth	15,000 cy	4.50	6.00
6	Earth excavation and refilling of pipe trenches from eight feet to less than 12 feet in depth,	7,000 cy	6.85	9.00
7	Earth excavation and refilling of pipe trenches from 12 feet to less than 16 feet in depth	3,000 cy	9.15	12.00
8	Earth excavation and refilling of pipe trenches 16 feet and more in depth	4,000 cy	12.35	13.00
9	Rock excavation	1,200 cy	15.00	8.00
10	Bituminized-fibre pipes	13,000 lf	1.60	.90
10	(Alternative) 6-inch or smaller vitrified pipes	13,000 lf	1.80	1.40
11	6-inch and 8-inch vitrified pipes	13,000 lf	3.90	3.50
12	10-inch vitrified pipes	2,600 lf	4.20	4.00
13	Tile pipes for underdrains	1,900 lf	1.20	1.20
14	Cast iron and steel pipes and fittings	135,000 lb	.23	.30
15	Miscellaneous metal work	85,000 lb	.34	.60
16	Galvanizing	19,000 lb	.07	.20
17	Steel for reinforcing concrete	165,000 lb	.20	.20
18	Articles of aluminum	3,500 lb	2.00	5.00
19	Concrete and brick masonry	1,300 cy	54.00	80.00
20	Dry rubble paving	100 cy	15.00	20.00
21	Rubble paving in mortar	250 cy	18.00	25.00
22	Portland cement	2,600 bbl	4.00	3.80
23	Sand, crushed stone and gravel	2,100 cy	6.00	6.00
24	Sand for filters and sludge bed	6,300 cy	9.00	8.60
25	Timber and lumber	20 M ft BM	210.00	400.00
26	Bituminous macadam pavement	600 cy	11.00	12.00
27	Resurfacing bituminous roads	3,400 cy	13.00	13.00
28	Sidewalks and cross walks	500 sy	6.00	4.50
29	Wire fencing	7,500 lb	.30	.60
30	Drilling well for water supply	70 lf	48.00	35.00
31	Miscellaneous equipment	Lump sum	5,250.00	15,000.00
32	Sewage pumps, motors and appurtenances	Lump sum	2,700.00	7,000.00
33	Cutting screen, motor and appurtenances	Lump sum	2,200.00	7,000.00
34	Filter dosing apparatus	Lump sum	1,750.00	3,500.00
35	Water supply pump and appurtenances	Lump sum	2,200.00	5,000.00
36	Chlorinating apparatus	Lump sum	4,800.00	7,500.00
37	Glass enclosure and appurtenances for sludge bed	Lump sum	3,850.00	7,000.00
38	Superstructures	Lump sum	27,700.00	35,000.00
39	Special work and equipment for electric power line	Lump sum	4,500.00	20,000.00
40	Sanitary services	Lump sum	10,000.00	2,500.00
41	Cleaning up	Lump sum	2,500.00	2,500.00

Simplify your construction jobs

WITH STRUCTURAL RIB BOLTS AND ANCO LOCK NUTS

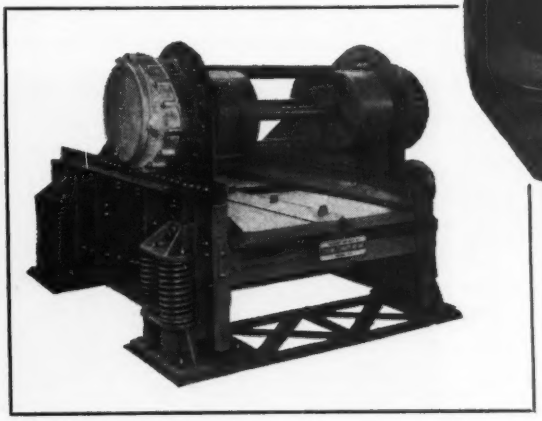
Lower costs and cut noise from riveting hammers

STRUCTURAL RIB BOLTS MADE THIS JOB EASIER



And this is only one of many construction jobs where Structural Rib Bolts with Anco Lock Nuts made the job easier. They are so easy to use that one man with a maul and wrench takes the place of a forge and rivetting team, thus are *labor saving*. The only ribbed bolt on the market with American Standard threads and the Anco lock nut, thus offers *exclusive safety advantages*. Moreover, they have unusual strength—tests show a ⅝" dia. bolt to be stronger than a ¾" dia. rivet. They're approved for Federal, State and Private projects. Furnished black or galvanized. Shear and bearing values equal to hot driven rivets.

ANCO LOCK NUTS DID A SECURE JOB HERE . . .



Neither shock nor vibration will loosen them! "Anco" lock nuts are used by the millions: on the market since 1930! Nut and lock are a single unit—no separate parts to be mislaid. Locks so securely only a wrench can unlock it, and can be used again and again. They comply with Federal Specifications FFB-571a. Price comparable to ordinary nut and lock washer, but far more secure and efficient!

For samples and complete data, write us today.

AUTOMATIC NUT COMPANY, INC.

LEBANON . . . PENNSYLVANIA

NEW PRODUCTS

A New Shovel Loader

The Dempster Diggster is a small shovel unit capable of handling large and small jobs alike. It works on a hydraulic crowd and hoist principle. Its ability to dig 15 inches under the grade, or 15 ft. above grade means that it can complete most excavating jobs unassisted. It can get into tight places, and with truck speed on the road it gets to and from a job fast. It can turn a complete circle in five seconds.—DEMPSTER BROS., KNOXVILLE, TENN.

Vertical Air Compressor

Developed by designing the unit with the tank upright and the motor and air compressor unit mounted on top. Available in three models: 25-V which has a 20-gal. tank with a 1½-cu.ft. per min. air displacement; 50-V which has a 30 gal. tank and displaces 2.7 cu.ft. of air per min.; and 75-V with a 30 gal. tank that displaces 4.07 cu.ft. of air per min. Model 25-V requires only 20 in. dia. of floor space and the other two models require only 24 in. dia. All three units are equipped with a single phase motor that operates on either 110 or 220 v. Model 25-v. has a ½-hp. motor, the 50-v., a ½-hp. motor, and the 75-v. a ¾-hp. motor. Made from high quality steel with electric welded construction, they have withstood a 400-lb. hydrostatic test and have a 200-lb. working pressure. Each is equipped with an automatic pop off valve and adjustable automatic switch.—THE GRIMES CO., DALLAS, TEX.

Two Arc Welding Machines

Ac. units of the transformer type, available in 150-, 200-, 300-, 400- and 500-amp. capacities, provide instant plug-in, plug-out of electrode leads by taper-type connector. Features include built-in power-factor corrector; finger-tip, stepless current control; fan-forced ventilation; wide current range and moderate open-circuit voltage operation. Direct current models have a one dial simplified control panel which carries a series of well-marked outlets, each one for an electrode of different diameter. Operator plugs into proper outlet, then dials for any required minor adjustments in current. Motor-driven dc. units are available in 150-, 200-, 300-, 400-amp. capacities in new compact 3,600 rpm. model and in conventional 1,750 rpm. type. Engine-driven welders include 200-amp. units powered by air-cooled Wisconsin engines, and 300- and 400-amp. sets driven by Chrysler industrial engines.—METAL & THERMIT CORP., 120 BROADWAY, NEW YORK 5, N. Y.

Bin Flow Aerator

Bin-Flo is a new aerating device to provide uniform and steady flow of bulk materials from bins, hoppers and chutes. Device is a small plate readily located at points where flow is restricted. Low-pressure air is injected into the material through a special fabric diffuser, causing material to flow freely.—BIN-DICATOR CO., 14615 EAST JEFFERSON AVE., DETROIT, 15, MICH.

Tractor Shovel

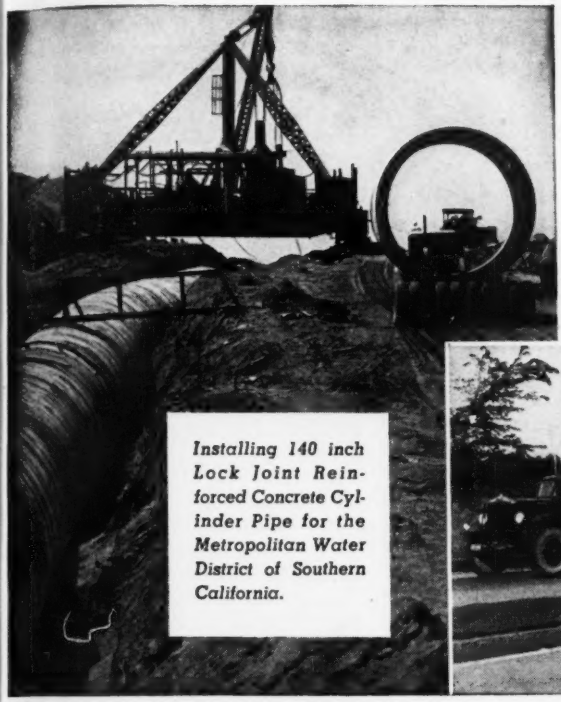
Improvement of ¾-cu. yd. Payloader Tractor Shovel involves hydraulic bucket control which dumps and closes bucket by finger-tip actuated hydraulic power. Bucket can be dumped gradually or instantaneously, and closed immediately by same hydraulic cylinder. Bucket need not be dropped to ground and tractor reversed to close it.—FRANK T. HOUGH CO., LIBERTYVILLE, ILL.

Portable Crusher Unit

The highway maintenance machine pictured above represents the products of three well known manufacturers, Athey Products Corp. makes the forced-feed loader and assembles the unit. Power is furnished by a Caterpillar diesel engine and the crushing plant is made by the Iowa Mfg. Co. With the use of this outfit material on road maintenance jobs can be salvaged, crushed to proper size and relaid on the road surface in one operation. In Wayne County, Mich., recently this combination with only three operators quickly reclaimed 3½ miles of old blacktop road. A motor grader first scarified the oil road to a depth of about four inches and windrowed the material. The force-feed loader picked this up and conveyed it to the portable crusher unit towed by the loader. There the material passed through breaker arms and over a screen which permitted fines to drop through to the road without entering the mill. Crushed material was then windrowed from the bottom of the machine.—ATHEY PRODUCTS CORP., 5631 W. 65 ST., CHICAGO 38, ILL.

FOR THE *Biggest* JOBS . . .

LOCK JOINT SERVES BEST!



Installing 140 inch Lock Joint Reinforced Concrete Cylinder Pipe for the Metropolitan Water District of Southern California.

Delivery of 138 inch Lock Joint Reinforced Concrete Cylinder Pipe for Boston Aqueduct.

A long record of successful contracts for the manufacture and installation of reinforced concrete pressure pipe in sizes from 16 inches to 150 inches has established Lock Joint Pipe Company as a leader in the field of water supply.

Significantly, Lock Joint Reinforced Concrete Pressure pipe is the first choice of larger municipalities engaged on water supply projects of unusual magnitude.

These are but a few of the major water supply installations built by Lock Joint throughout the past 40 years:

THE CITY OF BOSTON *selected Lock Joint Reinforced Concrete Cylinder Pipe for its 83,000 foot aqueduct. The diameter of the pipe for this huge project ranged from 84 inches to 150 inches.*

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA *chose Lock Joint for 114,000 feet of its water supply system. Lock Joint Reinforced Concrete Cylinder and Bar Cage Pipe ranging from 116 to 144 inches in diameter was used on this project.*

THE CITY OF CLEVELAND *is now engaged in the largest subaqueous pipe installation in history. The Nottingham intake will consist of 120 inch subaqueous pipe running 18,470 feet out into Lake Erie. For this project the City's engineers selected Lock Joint Subaqueous Pipe.*

LOCK JOINT *Reinforced Concrete* PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Est. 1905

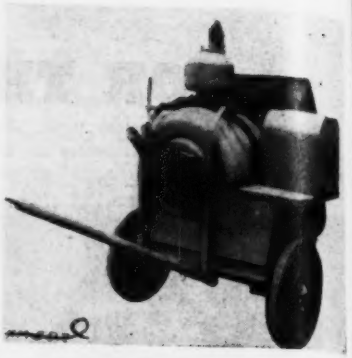
P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J. • Turner, Kan.

BRANCH OFFICES: Cheyenne, Wyo. • Denver, Colo. • Kansas City, Mo. • Joplin, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

SINK 'EM AND FORGET 'EM!
THEY'RE KOPPERS PRESSURE-CREOSOTED FOUNDATION PILES
That's the beauty of installing Koppers Pressure-Creosoted Piles—they are in to stay. The permeation of creosote protects these piles against decay, termites and acid or alkaline soils. And the wood retains the creosote year after year. Here's proof: some pressure-creosoted piles were pulled after being in use for nearly fifty years; they were still "loaded with creosote."
Koppers Pressure-Creosoted Piles are quickly available . . . are ready to be driven when received . . . are usually lower in cost than other permanent pile materials. Specify Koppers and you'll get economical and permanent piling.
KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.
KOPPERS
PRESSURE-TREATED WOOD
Modern building codes for permanent structures accept foundation piles of pressure-creosoted wood, provided the cut-offs are soaked in creosote and capped in concrete.



Concrete Mixer

Multiple V-belts replace the customary gear or chain sprocket drive on this small cement mixer. The 3½-S model changes the entry of water from the automatic water measuring tank through the charging side of the mixer. New lever arrangement on the hopper gate keeps operating parts outside hopper, and a manually-controlled shaker is provided for use when required.—KWIK-MIX CO., PORT WASHINGTON, WIS.

Compaction Roller

For this new roller, the Tournapacker, it is claimed that it gives required compaction in fewer passes because of the wide range of compaction pressure available. Ground pressure can be varied from 218 to 670 psi. by filling the drum with water and loading attached boxes with sand. The self cleaning feet are made of tool steel forging, tempered glass hard. They have a square base which tapers off to a round tamping surface of 8 sq. in. These tapered feet will not kick up compacted dirt.—R. G. LETOURNEAU INC., PEORIA, ILL.

Aerated Trailers

A new method of aeration is said to make dry bulk materials flow like water. Mixing air with material makes possible flow by gravity on only a four percent incline, and this is the principle used in Gramm aerated trailers. Lack of moving mechanical parts means lower maintenance cost and freedom from equipment lay-up. Aeration requires less power than other methods, while fast loading and discharge make possible more deliveries per day. Positive control of material discharge from either curb or street side of vehicle per-

Phil Savitz is the superintendent on the storm water tunnel job being driven for the city of Philadelphia by Robert Lombardi, general contractor. Mr. Savitz's full statement follows: "I have been on tunnel and other rock jobs in nearly every section of the United States and have used all types of bits. My choice is Timken every time."

When completed the Philadelphia water tunnel will be 1,800 feet long, 16 feet high and 13½ feet wide. It is being drilled through mica schist and quartz rock. Timken Rock Bits are used exclusively on the job.

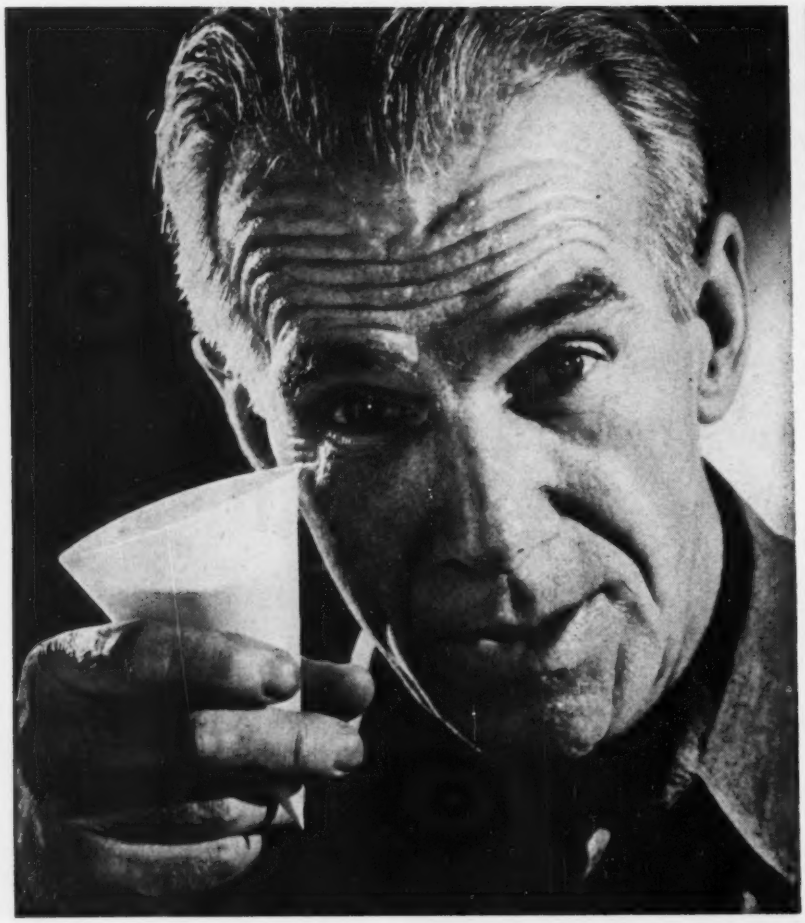
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
ROCK BITS

Drilling is done with jumbo rigs, each mounting six, 3½ inch piston drills operating at 90 pounds of air pressure. A "drill-up" of approximately 56 holes is accomplished in 40 minutes average time.

Commenting on the use of Timken Bits, Mr. T. E. Laws, general superintendent for Robert Lombardi writes: "Our past experience with your bits and the over-all economy obtained through their use were the governing factors in our decision to use them on this job. They have again proved their efficiency and economy. The drilling speed obtained through the use of Timken Rock Bits enables us to get a maximum number of 'drill-ups' per day and we expect to complete the job well ahead of schedule."

There's a Timken Rock Bit distributor at the other end of your telephone. Write for his name and address.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO • CABLE ADDRESS "TIMROSCO"



"Safest bet I know . . . pure, cool water in clean VORTEX CUPS"

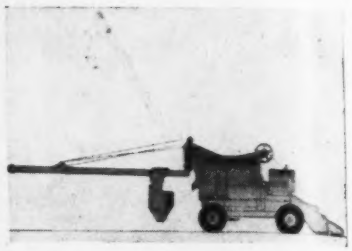
Best investment you can make on a job is a supply of Dixie or Vortex Cups. They help protect your men from colds and more serious mouth-carried infections . . . and they cost very little. An ideal way to use them is with the *new Dixie Portable Water Carrier*, which keeps four gallons cool for hours. *Write for new free illustrated folder to Dixie Cup Company, Easton, Pa.*

*"Vortex" and "Dixie" are registered Trade Marks of the Dixie Cup Company

DIXIE CUP

DIXIE CUPS, VORTEX CUPS AND PAC-KUP CONTAINERS ARE MADE AT EASTON, PA., CHICAGO, ILL., DARLINGTON, S. C. FORT SMITH, ARK.

mits perfect coordination with allied equipment, such as conveyors, mixers, automatic scales, etc. Licensed for manufacture by Huron Portland Cement Co., produced by—GRAMM TRAILER CORP., DELPHOS, OHIO.



Twinbatch Paver

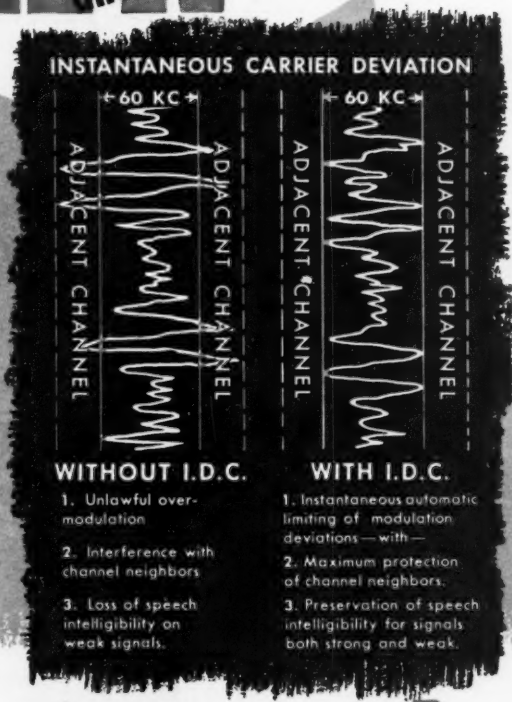
A small, maneuverable paver will perform economically and efficiently on intermediate paving jobs. The 16-E paver moves from job to job on pneumatic tires at speeds up to 8¼ mph. without damaging hard-surface roads. Maximum operating capacity is 48 to 50 cu. yd. per hour, based on 60-sec. specification. Features are dual wheels on the discharge-end and single wheels on the charge end, a two-compartment drum with overlapping action and automatic controls, an oscillating boom with 180° angular working range. Batchmotor controlled autocycle mixing, an automatic timing device for locking a batch in the drum, and a syphon-type water tank for better control of water-cement ratio.—KOEHRING CO., 3206 W. CONCORDIA AVE., MILWAUKEE 10, WIS.

Drywall Applicator

For the application and finishing of drywall joints a new invention, it is said, will enable one man to do the work of five by the old method. The "Superior" tape machine is valuable wherever perforated tape is used in new drywall construction, or for any similar new or repair job where the tape is not

NEW

another sensational first for Motorola research laboratories


INSTANTANEOUS CARRIER DEVIATION
60 KC
ADJACENT CHANNEL
ADJACENT CHANNEL
60 KC
ADJACENT CHANNEL
ADJACENT CHANNEL
WITHOUT I.D.C.
1. Unlawful over-modulation
2. Interference with channel neighbors
3. Loss of speech intelligibility on weak signals.
WITH I.D.C.
1. Instantaneous automatic limiting of modulation deviations — with —
2. Maximum protection of channel neighbors.
3. Preservation of speech intelligibility for signals both strong and weak.

I.D.C.

instantaneous deviation control

For the first time the deviation will be coordinated with the receiver bandpass to insure the greatest possible speech intelligibility on weak received signals.

Instantaneous Deviation Control

FM modulation control problems can *not* be solved by Speech *clippers, compressors* or *a.v.c. circuits* only. I.D.C. provides the fundamental scientific solution by controlling the steepness of the modulating wave front. Only by means of this instantaneous slope limiting action can *unlawful* excessive deviation be prevented.

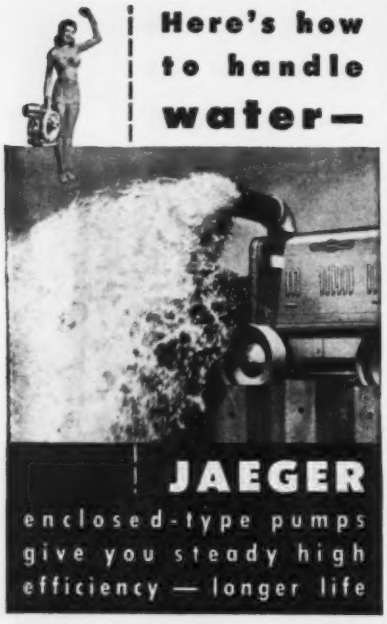
I.D.C. improves system operation and answers the F.C.C. proposed regulations for channel-neighbor protection.

WRITE TODAY

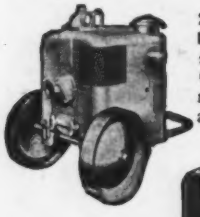
Your Motorola Communications Engineer will call to discuss the use of the new Motorola I.D.C. in your communications system. No obligation, of course.

Motorola Inc. COMMUNICATIONS DIVISION: 4545 AUGUSTA BLVD., CHICAGO 51, ILL.

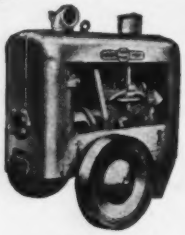
Motorola FM 2-WAY RADIO



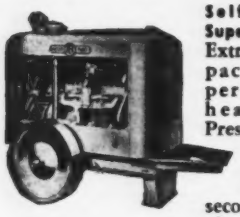
To a better engineered, more amply powered, conservatively rated line of pumps, Jaeger has added all-weather protection of all heavy duty models of 2" to 10" size — for sustained efficiency of pump and engine, extra hours of smooth, dependable performance, plus easy accessibility at all times.



2" and 3" Heavy Duty: Most rugged small pumps built. Conservatively rated @ 10,000 and 20,000 g.p.h.



4" to 10" Portables: Compact, extra powerful units of 40,000 to 240,000 g.p.h. rating and exceptional air capacity.



Self-Priming Super-Jet Pump: Extremely compact, yet outperforms old, heavy types. Pressures to 250 lbs.; 90 h.p. engine. Only 30 seconds to prime @ 20 ft.

Only Jaeger Offers All These
Inherent priming action plus "jet" priming — doubly sure and fast . . . long-life "Lubri-Seal," accessible for inspection . . . self-cleaning shell design . . . replaceable liners or seal rings . . . Every pump tested and certified for performance.

Sold, Serviced in 128 Cities

THE JAEGER MACHINE CO.
Main Office, Factory, Columbus 16, Ohio
1504 Widener Bldg. PHILADELPHIA 7, PA. — 226 N. La Salle St. CHICAGO 1, ILL.
235 American Life Bldg., BIRMINGHAM 1, ALA.

more than two inches wide. The cement and tape are uniformly applied in one operation. Made of magnesium casting, this machine weighs only 8 lb. loaded with tape and joint cement.—SUPERIOR DRYWALL APPLICATOR MFG. CO., WICHITA, KAN.

Handy Andy Dozer

The new "Handy Andy" angle dozer is powered by a gasoline engine. It stands only 3½ ft. in height, with an overall length of 7 ft. Three speeds forward and reverse, and a 6-foot turning radius enable it to do all clean-up work, back filling, road maintenance, slag leveling, towing, pushing and other excavating tasks. A special tilting front axle and hydraulic-powered front wheel steering enable it to maneuver into narrow areas and panelways, and do a fast, efficient dozer job.—CENTRAL MINE SUPPLY CO., MOUNT VERNON, ILL.

Truck Mixer

Hi Lo machine has stationary mixer drum octagonal in plan. Across drum is main mixer shaft of 5-in. cold rolled seamless tubing. With tapered design of drum, material flows down sides to come into contact with mixing wheels. Discharge gate is sliding type operated by pinions working on rack to produce positive cutoff. The unit is in the 3-yd. mixer classification.—CONCRETE TRANSPORT MIXER CO., 4985 FYLER AVE., ST. LOUIS 9, MO.

Longitudinal Finisher

For finishing Portland Cement concrete longitudinally, a finisher combines flexibility in width adjustments, a hydraulic screed lift, a change in the power unit position to shorten the drive shaft, and a cranking facility to effect changes in screed elevation for crown adjustments. A mechanically accurate final finish is produced.—KOEHRING CO., 3026 W. CONCORDIA AVE., MILWAUKEE 10, WIS.

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Always of the same uniform high quality, Gulf lubricants and fuels work as a team to help contractors do a speedier, more profitable job. Gulf lubricants provide an extra margin of protection —and Gulf fuels insure maximum engine power and efficiency.

F. M. Reeves and Sons, Austin, Texas, recently completed the rebuilding of over 11 miles of U. S. Highway № 183 between Baird and Coleman in Callahan County, Texas. Gulf quality lubricants and fuels helped keep their equipment rolling smoothly and efficiently.

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Purchasing Agent: *My dog didn't win even third prize! The judge said his ears are too ragged . . .*

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Yes, Arkwright has long been the buy-word for permanence in drawings. Unlike tracing paper, it does not crack and tatter with repeated use—nor become opaque and brittle with time as a file reference record. There are six big reasons why Arkwright Tracing Cloth is the better buy for *any* drawing that may be needed later. Keep a supply ready—it's a paying investment!

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Manufacturers' Publications

Tilt Up Construction—A photographically illustrated folder tells all about "tilt up" which provides a fast, form-saving method of concrete construction of great flexibility. For example, this method makes reinforced concrete wall construction as simple and economical as casting a slab on the ground, with the added saving and speed of power equipment erection. Bulkheads or edge forms, door and window bucks are the only forms required for building tilt-up wall panels. Several of the many applications of tilt-up are illustrated.—*Portland Cement Association, 347 Madison Ave., New York 17, N. Y.*

Ball Bearings—In a catalog on miniature ball bearings eight pages are devoted to comprehensive specifications on more than 40 type and sizes of standard miniature ball bearings.—*Miniature Precision Bearings, Inc., Keene, N. H.*

Bituminous Distributors—An interesting bulletin gives a complete description of an all-purpose heavy-duty bituminous distributor, with detailed information about the pump, tank, insulation, heating system, engine, spray bar, spray nozzles, etc.—*Kinney Mfg. Co., Boston 30, Mass.*

Sling Chains—Some valuable safety suggestions concerning the use of sling chains are contained in a 4-page circular describing the Sterling wrought-iron sling chains. They are: Do not overload; take up slack slowly; keep links straight; apply load on center of hook; do not put point of hook into chain link; be sure hooks are properly seated; use pads to protect chain from sharp edges; do not shorten chain by twisting or using bolts; avoid makeshift repairs; have chains annealed occasionally and retested; and consult table of recommended load limits.—*The Cleveland Chain & Mfg. Co., Cleveland 5, Ohio*

Aluminum Alloys—A new aluminum alloys and mill products data book is a 162-page volume which contains information as to alloys, tempers, sizes, shapes, physical, chemical and mechanical properties, and fabricating characteristics. Besides 163 tables of data there are 33 pages of explanatory text covering a wide range of related subjects. Wrought aluminum mill products and methods of producing them are described. A section on surface finishes

The Heavy Duty

MARION

111-M

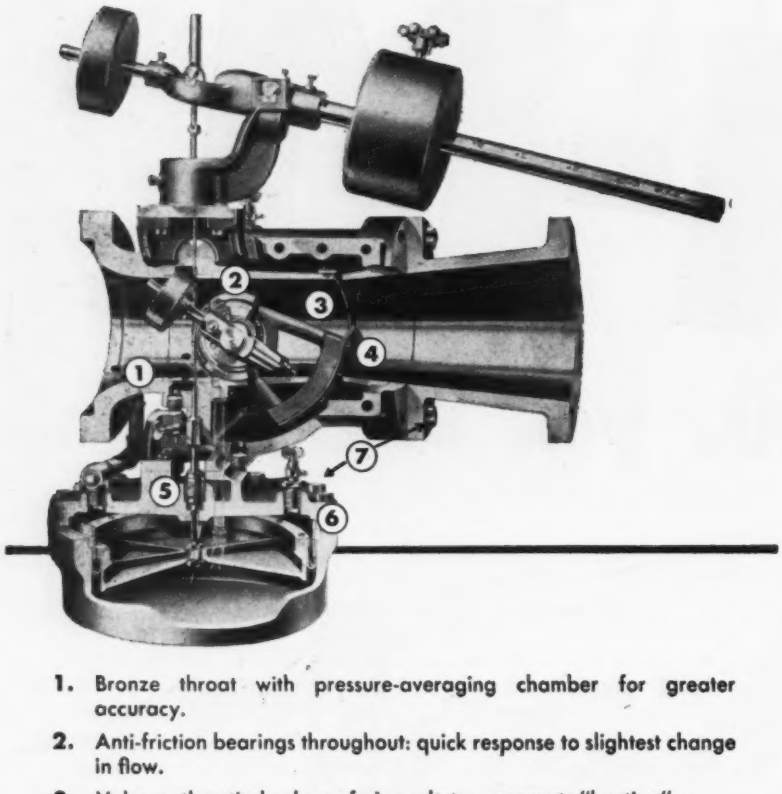
3½-4 cu. yd. shovel

MARION POWER SHOVEL CO.

MARION, OHIO, U. S. A.

7 GOOD REASONS

why more engineers, who demand the best in water works rate controllers, are specifying . . . "equal to Builders Model RCE":



1. Bronze throat with pressure-averaging chamber for greater accuracy.
2. Anti-friction bearings throughout: quick response to slightest change in flow.
3. Valve path entirely clear of air pockets — prevents "hunting".
4. Balanced control valve of arched design — will not buckle.
5. Hardened stainless steel piston rod . . . eliminates corrosion and bending.
6. Exclusive molded rubber piston seal won't bind, catch or reverse.
7. And something extra, — Everdur bronze bolts for easy maintenance.

For Bulletin 321B, address Builders-Providence, Inc.
(Division of Builders Iron Foundry), 51 Codding Street, Providence 1, R. I.

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Venturi, Propelofio and Orifice Meters • Venturi Filter Controllers and Gauges Type M and Flo-Watch Instruments • Kennison Nozzles • Master Controllers • Conveyoflo Meters • Wheeler Filter Bottoms • Filter Operating Tables • Manometers • Chronoflo Telemeters

BUILDERS PROVIDENCE
Instruments

for aluminum is also included, covering mechanical, chemical, electrolytic oxide, electroplate and organic finishes. The book was prepared by Harlan D. Jones and other technical service men. The book sells for a dollar a copy but is free to engineers, designers and technicians who ask for it on their company letterhead.—*Reynolds Metals Co., 2500 So. Third St., Louisville 1, Ky.*

Steel Water Lines—Job data are offered in an 8-page illustrated report on steel water lines laid in the United States during 1947. Pipe diameters, pipe wall thicknesses, line pressures, coatings, engineering personnel, etc., are listed.—*Dresser Manufacturing Division, Bradford, Pa.*

Soil Stabilizer—There are over a dozen pictures in a bulletin showing the P & H single pass soil stabilizer at work processing both soil-cement and soil-bituminous roads, streets and airports. One machine with one operator in a single pass performs these five distinct operations: Shaving and pulverizing the in-place materials; uniform application of all liquids; final mixing in twin pugmills; and spreading specified depth.—*Harnischfeger Corp., 4400 West National Ave., Milwaukee 4, Wis.*

Better Concrete—A 6-page folder shows how "Trimix", a liquid admixture, speeds up the handling, transporting and placing of concrete, mortar, stucco and cement plaster mixes, accelerates finishing operations, and adds to the strength and durability of completed structures.—*Building Products Division, L. Sonneborn Sons, Inc., New York 11, N. Y.*

Flood Control Pumps—The most spectacular feature of a pictorial review of interesting contracts completed by the three divisions of Hamilton-Thomas Corp.—Economy Pumps, Inc., Liberty Planers, Inc. and Klipfel Mfg. Co.—probably is a scene of the Ohio Valley flood control project, showing the giant economy flood control and drainage pumps, 36 of which were ordered for that work. The booklet also shows installations of Klipfel regulating valves and the machine tool operations of Liberty Planers, Inc.—*Hamilton-Thomas Corp., Hamilton, Ohio.*

Turbine Pump—A new turbine pump for small diameter deep wells capable of developing water capacities up to 5,000 gal. per hour from depths as great as 200 ft. has been announced. The Peerless Champion is an open line shaft pump. Bowl and shaft bearings are lubricated by the well's own water. No oil is used underground. Semiopen impellers, streamlined porcelain —

enameled bowl sections, and rubber bearings all contribute to smooth water lifting with minimum losses due to turbulence. All shafting is stainless steel.—*Peerless Pump Division, Food Machinery and Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif.*

Renewable Valves—A 12-page folder introduces the "Renewo" valve threesome. It illustrates in cutaway fashion the interchangeability of parts by which users of regular type "Renewo" valves can convert to either nickel alloy or stainless steel plug type valves by simply changing seats and discs. The renewable features reduce original and maintenance expense by lowering stock room investment, simplifying ordering and handling, and facilitating repairs.—*The Lukenheimer Co., Cincinnati 14, Ohio.*

Awning Windows—A little illustrated folder answers ten questions frequently asked about awning windows, which are said to offer better ventilation and circulation because the tilted sash deflects air currents upward and keeps the air at the ceiling moving, without need for fans or other circulation equipment.—*Gate City Sash & Door Co., Ft. Lauderdale, Fla.*

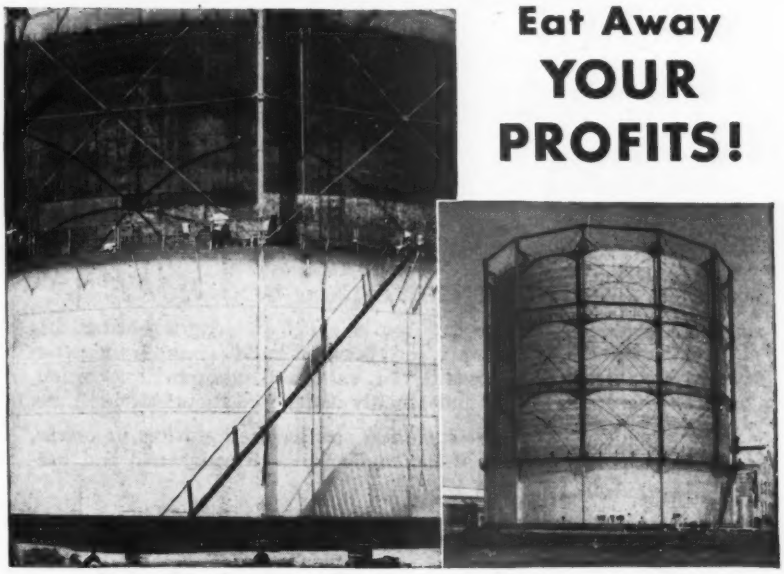
Small Tools—A new 28-page catalog presents a line of micrometers, vernier calipers, height gages and other machinits' tools.—*George Scherr Co., 200 Lafayette St., New York 12, N. Y.*

Pressure Grouting—Valuable literature has been issued on pressure grouting methods—fluid, plastic, inert—and on grouting pressures, by the manufacturers of Prehy equipment, which is used for soil stabilization, floor grouting, railroad track stabilization, solidification of fractured rock, restoration of structures, sealing off water, drypack concrete, and cast-in-place piles and pile encasing.—*The Prehy Co., Inc., 420 Lexington Ave., New York 17, N. Y.*

Bulldozing for Profits—This is the title of a new booklet showing some of the many uses of the bulldozer—including backfilling drainage ditches, and land clearing and leveling.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Cranes—A bulletin tells all about Gar Wood cranes which are full-powered in all operations—hoist, boom and swing—with an individual control for each function. Sensitive control and rugged strength make these cranes suitable wherever heavy valuable equipment such as transformers, motors, building materials, cast iron parts and machinery are to be handled.—*Gar Wood Industries, Inc., Wayne, Mich.*

Don't Let Rust and Corrosion Eat Away YOUR PROFITS!



Dum Dum for Metal being applied to the Gas Holder of the Pacific Gas and Electric Company.

The same Gas Holder completely finished with Dum Dum for Metal and protected for many years to come.

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Dum Dum for Metal now offers the same long-term protection to metal surfaces that its famed companion product, Dum Dum Masonoc, has been giving for years to all types of masonry structures. More than a paint, Dum Dum for Metal is thick, tough, elastic . . . designed specifically to protect metal surfaces against the hazards of weather-wear, industrial fumes and gases. Stops those deadly enemies of metal structures . . . rust and corrosion.

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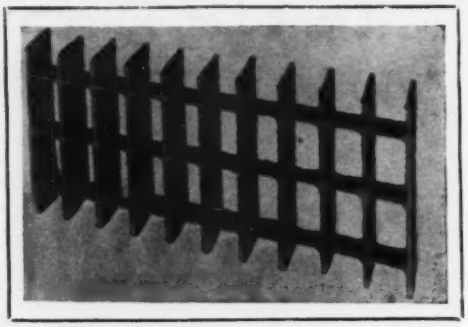

. . . under extreme conditions

The section illustrated was cut from a panel of Hendrick Mitco that for twelve years was in an open yard between buildings in an industrial plant. It not only was exposed to rain, snow and atmospheric corrosion, but was in a drainage area and actually under water much of the time.

The joints show the least corrosion and have no crevices or cracks, although the side surfaces of the bars have been roughened and partially eaten away.

Write for detailed information on Hendrick Mitco Grating, Open Steel Flooring, Shur-Site Treads, and Armorgrids.

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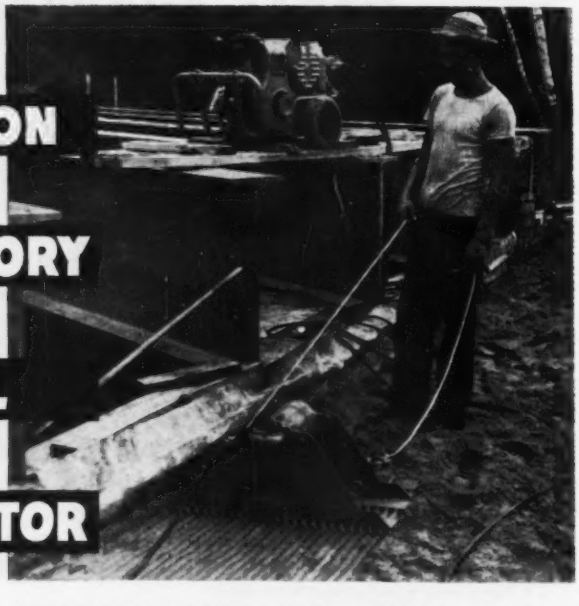

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Firmly Compacts Sub-bases of Factory Concrete Floors

Powerful vibrations give 95% of maximum density in a single pass (granular soils) to a depth of 12". Propels itself at a rate of 6' to 8' per minute, under normal conditions. Compacts 15 to 18 sq. ft. per minute. Eliminates paving delays, assures sound sub-base. Write for complete details.

ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Mich.

Diesel Engines—A new 24-page, profusely-illustrated booklet presents in graphic style the design features, specifications and work capacities of six International Diesel engines, from the 39-horsepower UD-6 to the new 180-horsepower UD-24. Illustrations show the engines stripped, as well as with various attachments. Accompanying performance charts reveal at a glance the peak, intermittent and continuous horsepower, and peak and intermittent torque at different engine speeds, as well as the average fuel consumption with wide-open throttle under intermittent load. A separate "Work it will do" table provides convenient listing of engine capacities in operating rock crushers, generators, hoists, sawmills and pumps.—*Industrial Power Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.*

Pile Hammers and Extractors—Newly revised, with additional information and illustrations, bulletins on double-acting pile hammers and extractors are now available for contractors, engineers and others in the construction industry. Ten sizes of hammers are illustrated, with full specifications, dimensions and lists of duplicate component parts. A useful formula for computing the bearing capacity of piles, a listing of available pile driving leads, and rigs for pulling piles with inverted hammers are other subjects covered.—*McKiernan-Terry Corp., 15 Park Row, New York 7, N. Y.*

Bottom Deck Feed—A 3-color, 12-page booklet explains the bottom deck feed of Pioneer Continuflo gravel plants which increases plant output by providing twice the pay screening area and continuous balance of the crushing loads between the primary and secondary crushing stages. There is independent screening of pit run and crusher run material on the same screen.—*Pioneer Engineering Works, 1515 Central Ave., Minneapolis 13, Minn.*

Heavy Duty Engines—An unusually handsome booklet has been issued by this manufacturer to describe its heavy duty air cooled engines. Four pages are devoted to explaining how Wisconsin engines are used in construction service.—*Wisconsin Motor Corp., Milwaukee 14, Wis.*

Flexible Metal Tubing—Two booklets, respectively, give valuable data on flexible metallic interlocked galvanized steel hose, bronze steam hose; and on the application of flexible tubing for air, oil, steam, gases and volatiles.—*Pennsylvania Flexible Metallic Tubing Co., 72d Street & Powers Lane, Philadelphia 42, Pa.*

Also Recorded

Busy Engineers — At Fayetteville, Ark., Henry George has resigned as airport engineer and building inspector but he will continue as assistant city engineer, assistant superintendent of the water plant and chief of the fire department. In St. Stephen, N. B., H. M. Balkam, civil engineer, is a member of the provincial legislature, operates a stable of trotters and pacers, and owns a garage and service station.

Busy Beavers—While engineers were still just talking about building a dam across Sacandaga Creek near Glen Falls, N. Y., industrious beavers finished a 250-ft. dam, flooding 15 ac.

Light Fingers—In Livingston County, Mo., a 30-ft. steel bridge has been stolen. The thieves apparently dismantled the structure in broad daylight and hauled the steel away. Arrest of a former custodian at Great Lakes Naval Training Station revealed the theft of an entire house from the training base. The $10,000 structure disappeared piece by piece over a long period, investigators said.

Snake Pit—Fred J. Snow, a Bonville, N. C., contractor had to work fast when he nearly stepped on a nest of five writhing copperheads on the floor of a dry cesspool. He slew them all with a trowel.

Act of God—A woman in Adrian, Mich., has sent the city commission a claim for $26.22 for costs of cleaning the basement of her house after a cloudburst which caused a sewer to back up. Mayor H. W. Lundahl opined it was an "act of God" and therefore not chargeable to the city.

House Divided—A small house at Georgetown, Ill., located in the path of new road construction was sawn in two despite the owner's protest. A jury in condemnation proceedings awarded him $650.

Macabre—A citizen of Reno, Nev., has objected to the use of the word "expired" which appears on the city's parking meters when the parking time has run out. In a note to city councilmen, he called the word "depressing, discouraging and dismal." Suggests the word "violation" instead.

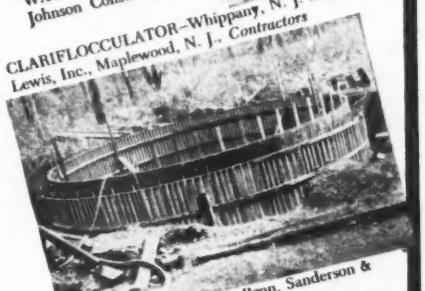
Merry-go-round—Palo Alto, Calif., is going to have to spend $2,650 for a boy-tight fence around its new sewage treatment plant. Local youngsters have been using the long arms of the biofilter as a merry-go-round.

The same
ATLAS SPEED FORM UNITS DID *ALL* THESE JOBS . .

Basic unit, Speed Panel of rugged steel

• WALLS • FLOORS • COLUMNS
• DAMS • MANHOLES • CIRCULAR TANKS

FLOOD WALL GATE-WAY—Newport, Ky. W. L. Johnson Construction Co.



CLARIFLOCCULATOR—Whippany, N. J. Anthony Lewis, Inc., Maplewood, N. J., *Contractors*

WALLS—Power Plant, Courtney, Penn. Sanderson & Porter, *Engineers & Contractors.*

FLOORS—American Sanitary Partition Co., L. I. City. Cardinal Construction Co., *Contractors.*

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'DUCKING BRIDGES'

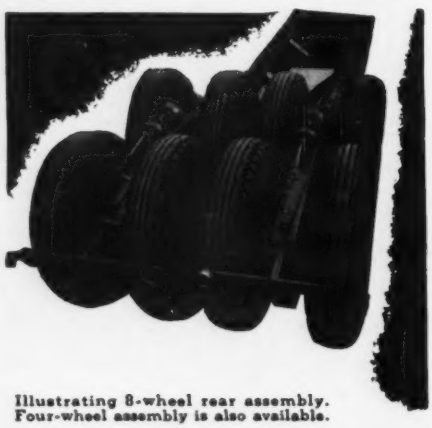
Photo Courtesy Weston Hauling, Inc., Glenshaw, Pa.

with 77 TONS OF SHOVEL ON A ROGERS GIRDER TYPE TRAILER

These heavy duty trailers are designed and built for the lowest possible road clearance.

Although not limited to such work they are used to a large degree in the transporting of crawler-mounted machinery of large size.

Rogers Girder Type Trailers have proven indispensable in areas where low bridges are prevalent or where other limited headroom clearances are encountered.



Illustrating 8-wheel rear assembly. Four-wheel assembly is also available.

Loading is accomplished by removing the rear wheel assembly. The machine moves into position over the girder. The frame is then jacked up and rear wheels attached. The load is in position ready to roll.

ROGERS BROS. CORP.

DESIGNERS and BUILDERS OF HEAVY DUTY TRAILERS SINCE 1915

EXPERIENCE builds 'em PERFORMANCE sells 'em

135 ORCHARD ST. ALBION, PENNA.

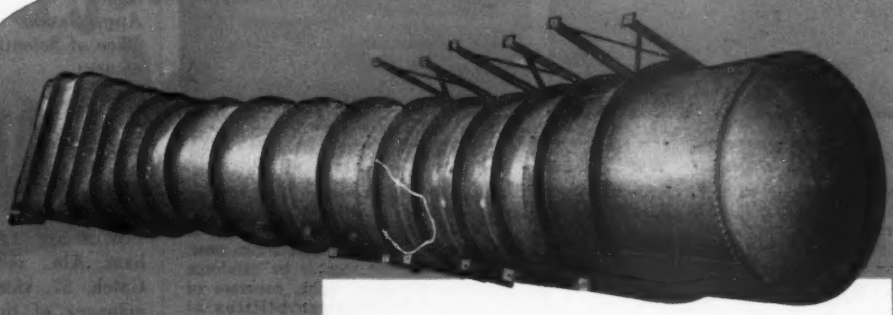
Manufacturers' Activities

Sales—Edmund T. Flanagan, manager of the New York sales division of THE FAIRBANKS CO. has been manager of regional sales also. . . . R. B. Boand is sales manager for a new machine-braided sling rope developed by the UNION WIRE ROPE CORP. He is at the home office at Kansas City, Mo. J. J. Lester is sales representative in Oklahoma; C. L. Conway, Kansas; L. A. Davis, Montana, North and South Dakota, Minnesota and Wisconsin; D. E. Bedford, Iowa and Nebraska; and D. B. Currence, Chicago. . . . R. W. Rodgers is manager of industrial sales and F W. Lagerquist is manager of asphalt roofing sales for the CELOTEX CORP., Chicago. . . . Bert T. Thompson will represent the construction equipment division of SMITH, INC., Fargo, N. D., in ten counties in northwestern Minnesota. . . . David E. Rizor is assistant to John P. Courtright, vice-president in charge of sales for MARION POWER SHOVEL CO. His successor as district manager at Chicago will be C. M. Gegenheimer. . . . Geo. L. Cobb has been appointed district sales manager for SOULE STEEL CO. at San Francisco. . . . Roy H. Smallwood is sales manager for the LULL MFG. CO., Minneapolis, Minn.

Distributors—H. B. FULLER EQUIPMENT CO., Cleveland, Ohio, has been appointed a dealer for DAVEY COMPRESSOR CO. . . . MILLER, BRADFORD & RISBERG CO., INC., Eau Claire, Wis., have been made distributors for R. G. LE TOURNEAU, INC. . . .

Personalities—Harry C. Shields is eastern manager of the construction division of THE PRESSTITE ENGINEERING CO., St. Louis, Mo. . . . A gold fellowship certificate in the American Society of Mechanical Engineers has been awarded to C. G. A. Rosen, director of research at the CATERPILLAR TRACTOR CO. . . . Edward F. Young of the Minneapolis Office of UNIVERSAL ATLAS CEMENT CO. has been appointed general chairman of the annual exposition and conference of the Minnesota Federation of Engineers to be held in Minneapolis Feb. 23-26. . . . R. D. Hiller, Jr., is south central regional manager of GAR WOOD INDUSTRIES, INC, at Tulsa, Okla. . . . W. J. Goodwin, Jr., president of the DES MOINES CLAY PRODUCTS CO., has been elected president of the STRUCTURAL CLAY PRODUCTS INSTITUTE. . . . H. C. Anderson, Omaha, has been appointed regional director for Associ-

Sometimes It's a "Pipe"
To Reduce PIPE COSTS!



WROUGHT IRON
STEEL AND
ALLOY STEEL PIPE

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TEES
ELBOWS
AUTOCLAVES
TANKS

Some pipe users, seeking to reduce Wrought Iron Pipe costs, don't know where to turn. Others cut costs so easily it's a "pipe". Experience has taught them that they can often obtain worhwhile savings simply by turning to Posey.

Here are 5 reasons why switching to Posey may lower your pipe costs:

1. Posey economy-engineering streamlines away needless, expensive fabrication steps.
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3. Posey Wrought Iron Pipe effects installation economies because Posey engineering assures good flow capacity . . . holds pipe diameters and trench depths to a minimum.
4. Posey Wrought Iron Pipe cuts installation costs. Durable construction resists time and pressures . . . tight joints seal out roots.
5. Posey delivers "as specified". No length of pipe leaves our plant until it has been thoroughly tested.

On your next job, for pipe of 14" dia. and larger, ask us for estimates and designs that may point the way to cost reductions. No obligations.

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CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

SAVED WITH "GUNITE"

Above is shown the stadium of Sharon High School at Sharon, Penna. This is a poured concrete structure, built in 1933, and after only eight years disintegration was very serious and endangered the stability of the structure.

In 1941 we were called upon to strengthen and recondition this stadium, which we did with reinforced "GUNITE" of two inch minimum thickness.

The view to the left shows the chipping and sandblasting completed and the reinforcing mesh in place. To the right is the completed job, better than when new.

Before you restore, repair or reinforce any structure of stone, brick, concrete or metal, discover the possibilities of "GUNITE."

Write for full information today.

MANUFACTURERS OF THE "CEMENT GUN"

Electroline—FIEGE
WIRE ROPE
CONNECTORS
The LAST WORD *in*
SAFETY
SPEED
SAVINGS

No heat, acids or complicated equipment required for installation. Ordinary mechanic's tools do the job, safely, even in chemical plants, powder plants and mines, where other methods would be prohibited. And they are safe to use, because they have the highest holding strength of any known wire rope or strand connectors. They assure *savings in installation* because unskilled labor can do the job easily and quickly; *savings in use* because they prolong wire rope life by damping vibration and overcoming rope fatigue at entrance to fitting . . . and because they are reclaimable.

Note ease of installation →

Simply slip the sleeve over the cable, spread the strands, insert and drive in the plug then apply the socket. See what a solid and permanent joint you have by looking at it through the inspection hole put there for the purpose.

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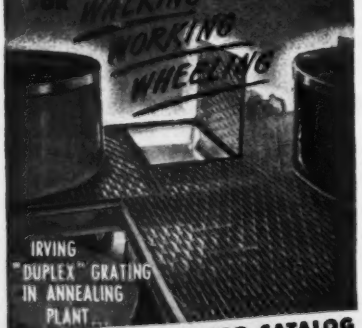
Do you know that every year thousands of plants are made
SAFER
MORE COMFORTABLE
MORE EFFICIENT

IRVING GRATINGS
(OPEN STEEL MESH FLOORING)



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ATED EQUIPMENT DISTRIBUTORS for Iowa, Kansas, Missouri, and Nebraska. . . . William Furber Smith, former engineering director of the "Manhattan Project" wartime research unit of the CARBIDE and CARBON CHEMICALS CORP., has joined the UNITED STATES TESTING CO., INC., Hoboken, N. J., to organize a new engineering inspection service in connection with building and building material. . . . J. T. Callaway, assistant to the vice-president of the GOODYEAR TIRE & RUBBER CO. has completed 30 years service with the company. . . . Paul H. Davey, president of DAVEY COMPRESSOR CO., Kent, Ohio, has received a War Department Certificate of Appreciation for his services to the office of Scientific Research and Development.

Deceased—Simpson S. Burke, 53, Pacific Coast manager of the MARTIN-SENOUR CO., Chicago died in Los Angeles Oct. 25. . . . R. P. Thompson, 53, of the sales organization of MARION POWER SHOVEL CO. died in Birmingham, Ala., recently. . . . Benton R. Gatch, 57, vice-president and general manager of the PAVING SUPPLY and EQUIPMENT died on Oct. 24 in Baltimore, Md. . . . Eugene T. Scott, 35, former sales manager of TEMPLETON, KENLY & CO., Chicago, manufacturers of Simplex jacks, died recently in Hinsdale, Ill. . . . Robert W. Porter, 60, assistant to the president of THE NATIONAL RADIATOR CO. died Oct. 26 at South Orange, N. J. . . . Eugene M. Morehand, 47, plant engineer of the Sandusky plant of NEW DEPARTURE division of GENERAL MOTORS, died Oct. 20.

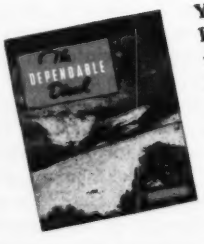
Miscellany—A new factory branch building is now being constructed at Birmingham, Ala., for the saw division of R. HOE & CO. INC. . . . Ivy H. Smith, president of the SHERMAN CONCRETE PIPE CO. of Florida has been elected president of the recently formed SOUTHEASTERN CONCRETE PIPE ASSOCIATION. . . . T. Barton Ford, manager of foreign sales for the DORR CO., New York, is on a round-the-world trip by air to visit several of his company's widely scattered offices, representatives and resident engineers. . . . WM. H. ZIEGLER CO., INC., Minneapolis, Minn, has set up an engineering service under Robert Bliesath to aid customers in connection with material handling problems. . . . Over 100 distributors and salesmen attended THE ARKETEX CERAMIC CORP.'s recent national sales conference in Terre Haute and Brazil, Ind. . . . The 62-year-old RUBBEROID CO. produced 1,030,000 tons of finished building materials during the last year. . . . U. S. RUBBER CO. on Oct. 26 announced increases of from 5 to 10 percent in prices of electrical wire and cable. . . . CARNEGIE-ILLINOIS STEEL

What makes a job Tough

Heaped loads . . . steep grades . . . long or short hauls. That's when Cummins Diesels "pay off" . . . hauling more material at low cost.

CUMMINS Dependable DIESEL

SINCE 1919 PIONEER OF PROFITABLE POWER THROUGH HIGH SPEED DIESELS

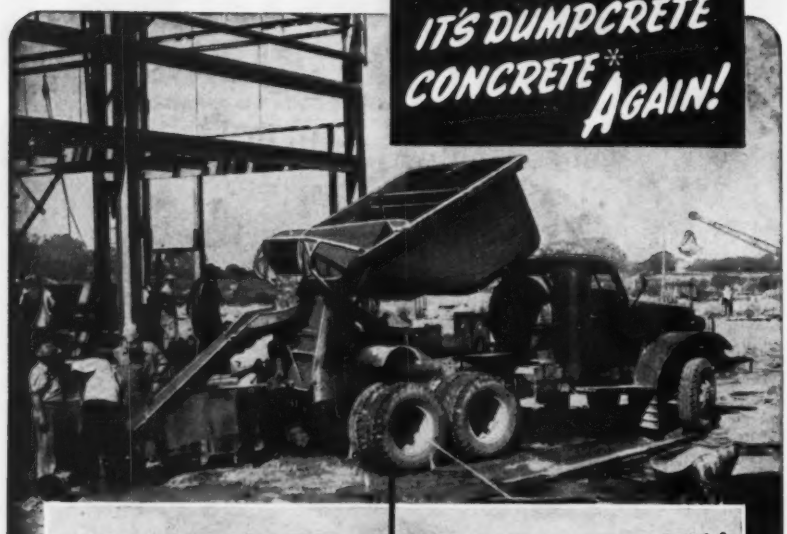


Your Cummins Dealer will show you other examples of the performance of Cummins Diesels in the current issue of *The Dependable Diesel.*

Colonial Sand and Stone Company, Inc., New York City, finds Cummins Diesels better for its job. One of the first contractors to find Cummins Power profitable for short hauls, Colonial now operates a total of 197 Cummins Diesels.

Colonial's Cummins-powered fleet includes 10 new Model D 664-MA Federal ready-mix trucks powered with Model NHB-600 Cummins Diesels, and two FK Macks recently repowered with Model NHB-600 Engines. Used to haul heavy slag and sand in New York's hilly Eastchester area, the repowered FK Macks cut delivery time 50 per cent and fuel costs 25 per cent.

CUMMINS ENGINE COMPANY, INC. • COLUMBUS, INDIANA



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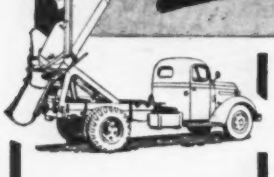
IT'S DUMPCRETE CONCRETE* AGAIN!

DUMPCRETES HAUL 14 MILES IN CHICAGO TRAFFIC



The Imperial Ready Mix Company's 14 Dumpcretes are busy hauling top-quality air-entrained concrete in and around Chicago.

The above photo shows a Dumpcrete pouring foundation piles at the new A. B. Dick Co. plant after a 14-mile, 50-minute haul.

By controlling the mix at the central plant, every load is uniform. Each has just the right amount of air to maintain top-to-bottom uniformity. No additional air is beaten into this "controlled mix" by the non-agitating Dumpcretes during the haul . . . so the delivered concrete is all according to specification.

The Dumpcretes save money too. They cost less to buy and less to run.

Every concrete man wants to deliver better concrete at lower cost. Write for complete information today.

The Dumpcrete Body

Lightweight, watertight, loads fast, dumps fast or slow, places anywhere, costs less to buy and run. Ideal for hauling aggregate, coal and earth.

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*** Dumpcrete Concrete**

is central-mix air-entrained concrete hauled and placed with the speedy, low-cost Dumpcrete. Provides top-quality, plastic, workable and non-segregating concrete, saving up to $1.00 per yard.

DUMPCRETE DIVISION
MAXON CONSTRUCTION CO., INC.
505 Talbott Bldg., Dayton 2, Ohio

Stang WELLPOINT SYSTEM.

For
KNOW-HOW
•
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EQUIPMENT
to keep jobs
DRY

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CORP. and NATIONAL TUBE CO., subsidiaries of UNITED STATES STEEL, on Oct. 27 announced that owing to the increase of one-half cent a pound in the price of zinc made on Oct. 23 by leading producers, they have made corresponding adjustments in the prices of galvanized sheets and other products coated with zinc, in accordance with a standard formula, which provides for automatic increases or reductions in prices of zinc-coated products in keeping with the current price of the commodity. Accordingly, CARNEGIE-ILLINOIS, revised extras for all galvanized sheet products by an average of approximately $1.25 a ton, or about one per cent in the price of such products. NATIONAL TUBE announced that base discounts on galvanized pipe were decreased by one-half point the effect of this change being an increase of approximately $1 a ton, or less than one per cent in the price of galvanized pipe.

Steel bar industry hears price, cooperation talks

Representatives of the reinforcing bar industry, convened recently at Asheville, N. C., in a joint meeting of the Concrete Reinforcing Steel Institute, American Iron and Steel Institute's Committee on Reinforced Concrete Researches, and the Steel Joist Institute.

Featured speakers at the five-day meeting were William T. Simon, general counsel for the Capehart Committee, who spoke on the objectives of that group, and H. E. Foreman, managing director of the Associated General Contractors, whose subject was cooperation in the construction industry.

Canadian housing costs are still rising

Canadian housing costs are still rising, according to a review just published in Ottawa, even though labor and materials are proving somewhat easier to find for house building operations.

For the first six months of the year, wages in the building industry stood 7.6 percent higher than 1947, with materials only 2.0 percent higher, giving a combined average increase in cost of 4.9 percent. Actual housing costs are affected also by overhead and profit charges, so that this percent cost increase is no true guide to the housing cost to the purchaser.

In towns and cities 21,000 houses were completed this year as against 18,000 for the same period last year; 24,000 houses were started in the six-month period of 1948, as against 20,000 in 1947.

Elections and Activities

Flood control problems in the West and Midwest and pollution of the Detroit and St. Clair Rivers were major matters dealt with by the International Joint Commission in Ottawa session Oct. 13. A. O. Stanley of Washington presided, with George Spence, acting chairman for Canada. The commission will hold further meetings in Detroit, Mich., and at Windsor, Ont., regarding the pollution of the board waters of the Detroit and St. Clair Rivers, and also at Sault Ste. Marie, regarding the pollution of the St. Mary River. A report was presented by Victor Meek, controller of the Dominion Water and Power Bureau, on recent surveys in the west. A report was received from the International Souris Red River Engineering Board on studies to be made of the flood control measures planned for the Winnipeg district.

City Manager R. M. Cooksey of Thomasville, N. C., has been elected president of the North Carolina League of Municipalities. Board of directors: City Manager H. L. Burdette of Hickory and City Manager F. Talmadge Green of Wilson. Included in the legislative program adopted was a proposal that one-sixth of the revenue collected on gasoline be returned to the municipalities. J. Ray Shute, of Monroe, chairman of the legislative committee, told the league that it would be a good idea for it to abandon its request for a return of taxes on gasoline used by municipal vehicles and concentrate on the new approach. Municipalities now get $1,000,000 annually from the state for maintaining highways.

Expected yield from the proposed rebate would be between $7,000,000 and $10,000,000 annually. Other officers elected: H. H. Baxter of Charlotte, first vice-president; George W. Lentz of Winston-Salem, second vice-president; and J. W. Joyner of Farmville, third vice-president; Robert H. Cowan of Williamston, George W. Dill of Morehead City, J. W. Hoffler of Wallace, J. A. McDowell of Scotland Neck, W. Bowman Sanders of Burlington, Malcolm B. Seawell of Lumberton, J. Ray Shute of Monroe, Herman C. Wilson of Greensboro, Gordon Winkler of Boone, and W. W. Shope of Weaverville, directors.

Lloyd Heller, chief engineer of the Fort Dodge, Ia., sewage treatment plant, has been elected president of the Iowa Sewage Works association. Other offi-

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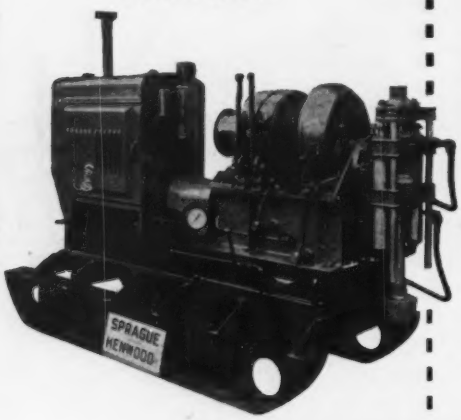

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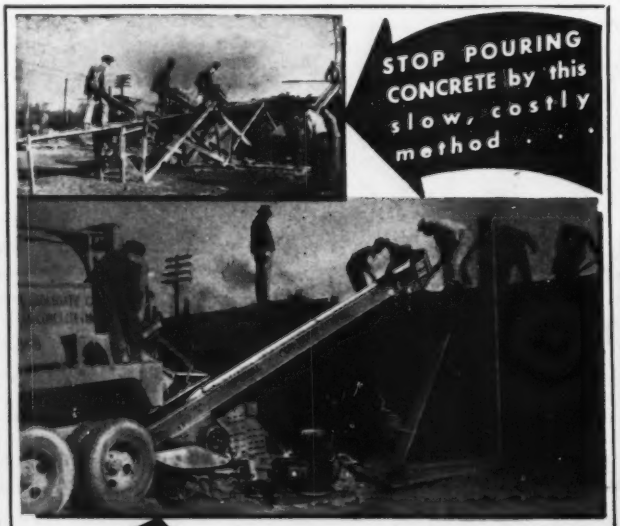
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cers are Forrest E. Grover, city engineer of Council Bluffs, vice-president; and Leo Holtkamp, superintendent of the sewage works at Webster City, secretary-treasurer.

Donald F. Carpenter, of Southport, Conn., chairman of the U. S. Munitions Board, has been elected to life membership on the Corporation of the Massachusetts Institute of Technology. A graduate of M.I.T., Mr. Carpenter was elected to the corporation first in 1943 for a five-year term. Now in Washington, he is on leave from the Remington Arms Company, Inc., of which he is vice-president and assistant general manager.

The Rockland County chapter under the chairmanship of Newton F. Ronan, was host for the autumn meeting of the N. Y. State Society of Professional engineers at Bear Mountain State Park recently. Among the resolutions adopted were one to encourage the insertion in collegiate bulletins of the requirements to be met and the procedures to be followed in obtaining a professional engineer's license; another to cooperate with the New York Association of Highway Engineers in their efforts to get salaries commensurate with their professional standing and responsibilities; while one to consider permitting the partial substitution of teaching experience in meeting the requirements for a professional engineer's license was referred to the committee on amendment of the education law.

Elected president of the North Dakota Water and Sewage Works Conference is George Toman of Mandan, succeeding R. J. Lockner. Other officers: A. F. Hulting, city engineering of Grand Forks, vice-president; and J. H. Svore, Bismarck, state sanitary engineer, renamed secretary-treasurer.

OBITUARY

Isidor D. Raffin, 58, vice-president and chief engineer of Barrett & Hilp, San Francisco construction firm, died Nov. 8. With the firm since 1926, Mr. Raffin had supervised its work on both the Golden and Oakland-San Francisco Bay bridges. He also supervised construction of a 5,000-unit war housing project in Portsmouth, Va.

George W. Manley, 68, died in San Francisco Nov. 8. For 10 years city engineer of San Anselmo, Calif., he later served as resident engineer for several PWA construction projects. During the war he was senior construction cost auditor on the Pacific Coast

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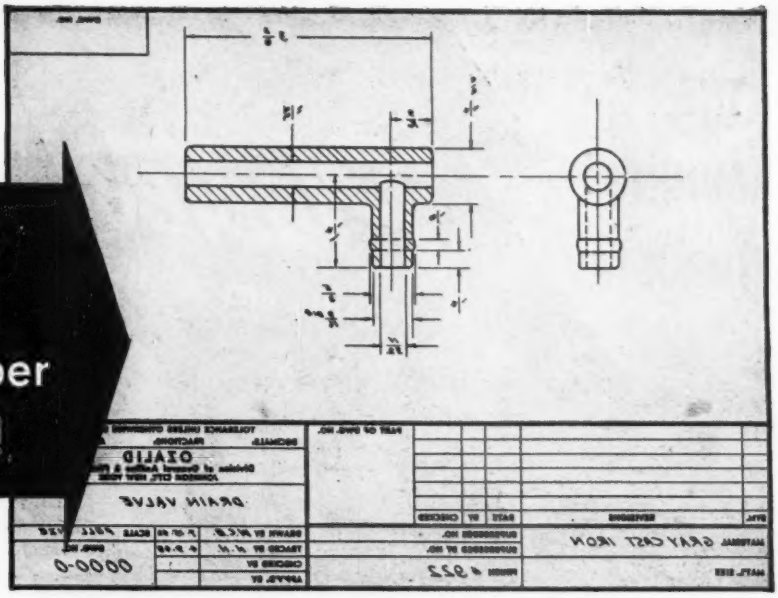

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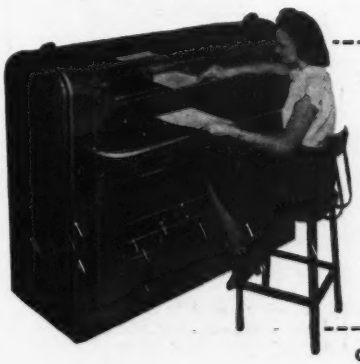

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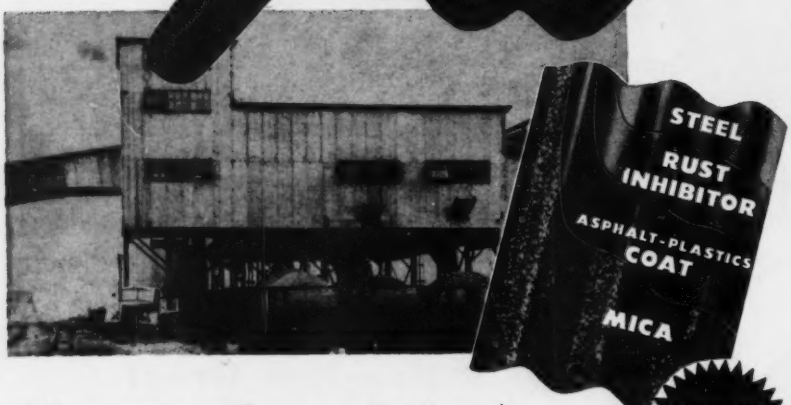

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John R. Pennington, 77, died in San Jose, Calif., Oct. 28. Born in Texas, he perfected the hydraulic rotary well drilling process used widely in that state. A pioneer in irrigation development in Santa Clara County in California, he had served as chief engineer for the Gravity Canal irrigation project at Bay City, Tex.

Nathan S. Rogers, 70, a consulting engineer of St. Louis, Mo., for about 35 years and a member of the Rogers-Schmidt Engineering Co., died Nov. 10.

James J. McHugh, 62, commissioner of public works for Worcester, Mass., died Nov. 10 in that city. He was engaged on public works in many sections of the country, including Arizona and California. He was appointed commissioner of public works in Worcester last January.

Walter B. Powell, 64, chief of the Conservation Commission's Parks division, died Nov. 6, in Charleston, W. Va.

James Dyer Jones, 67, partner in H. A. Brassert & Co., New York steel engineering firm, and former chief engineer of Youngstown, Ohio, died Nov. 7 in New York. He was in charge of all Sheet & Tube Co. improvements from 1935 until he resigned ten years later to join Brassert & Co. He built the Campbell, Ohio strip mill, the seamless tube mill, and other projects. He was responsible for building the "D" blast furnace in Campbell.

John H. Murnane, 64, vice-president and general manager of the John H. Murnane Co., Cleveland, general contractors, died Nov. 8.

Virgil A. Richards, 58, for eight years superintendent of highways in Huron County, Ohio, died Nov. 10 in Willard, Ohio.

Burton Temple, 77, died at Halifax, N. S., Nov. 6. He was a graduate of the Dalhousie University engineering school, Halifax. For about 30 years he had been on the engineering staff of the Canadian government in the public works department, stationed at Halifax. He retired about four years ago.

William H. Yeager, Thurston County engineer at Olympia, Wash., died there Nov. 9.

Paul Cochran Richards, 77, retired civil engineer, died at Warrenton, Va., Nov. 9.